DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
700 FEDERAL BUILDING
KANSAS CITY, MISSOURI 64106-2896

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REPLY TO
ATTENTION OF

December 30, 2003

SUPERFUND DIVISION

Environmental Programs Branch

Jim Harris
Missouri Department of Natural Resources
205 Jefferson Street
P.O. Box 176
Jefferson City, Missouri 65102

Dear Mr. Harris:

Enclosed are hard copy versions of comment responses on the SSEBS for the St. Louis Army Ammunition Plant (SLAAP) Site, comment responses on the Human Health Baseline Risk Assessment, and a revised diagram for the site conceptual exposure model. Our contractor, URS, submitted the electronic copies of these documents to you on December 30, 2003. As was discussed during the December 23, 2003, conference call, the Army is hoping that an expedited review of these comment responses will be possible, so that actions on the SLAAP Site can move forward as soon as possible.

If you have any questions or if I can be of assistance in any way, please feel free to call me at (816) 983-3798 or e-mail me at jill.k.fraley@nwk02.usace.army.mil. Thank you for your guidance and support of these efforts.

Sincerely,

Jill K. Fraley, RG
Project Manager

cc: Project File w/ attachment (200-1f)
    Tom Lorenz, USEPA w/attachment
    Jerry Preston, HQDA BRAC Atlanta w/o attachment

Section 1. SSEBS

Section 4 Table Revisions

Responses to MDNR SSEBS Comments

Responses to EPA SSEBS Comments

SECTION 4 TABLE REVISIONS:

4.2 BUILDING 2

4.2.4 Soil

Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:

Field ID	Analyte	Result	Screening Level	Units
PCBs				
02SB-01(09-10)-0902**	PCB-1248	2.5	0.22	MG/KG
	Total PCB*	2.5	0.22	MG/KG
02TS-02(0-0.5)-0802	PCB-1248	6.2	0.22	MG/KG
	Total PCB*	6.2	0.22	MG/KG
02TS-08(0-0.5)-0902	PCB-1248	1.3	0.22	MG/KG
	Total PCB*	1.3	0.22	MG/KG
02TS-09(0-0.5)-0802	PCB-1248	1	0.22	MG/KG
	Total PCB*	1.023	0.22	MG/KG
RA-02SB-01(0-0.5)-0902	PCB-1248	14	0.22	MG/KG
	Total PCB*	14	0.22	MG/KG
Dioxins				
02SB-01(0-0.5)-0902	Dioxin TEQ*	11.9	3.9	PG/G
02SB-01(09-10)-0902**	Dioxin TEQ*	304	3.9	PG/G
02SB-02(0-0.5)-0902	Dioxin TEQ*	96.4	3.9	PG/G
02SB-02(09-10)-0902**	Dioxin TEQ*	7.62	3.9	PG/G
02SB-03(0-0.5)-0902	2,3,7,8-TCDD	15.9	3.9	PG/G
	Dioxin TEQ*	95.5	3.9	PG/G
02SB-04(04-05)-0902	Dioxin TEQ*	32.1	3.9	PG/G
02SB-04(09-10)-0902**	Dioxin TEQ*	19.3	3.9	PG/G
02SB-05(04-05)-0802	Dioxin TEQ*	8.23	3.9	PG/G
Dioxins (cont.)				
02SB-05(09-10)-0802**	Dioxin TEQ*	9.36	3.9	PG/G
02SB-08(0-0.5)-0802	Dioxin TEQ*	97.3	3.9	PG/G
02SB-09(04-05)-0802	Dioxin TEQ*	5.2	3.9	PG/G
02SB-09(09-10)-0802**	Dioxin TEQ*	3.91	3.9	PG/G
02TS-02(0-0.5)-0802	Dioxin TEQ*	84.3	3.9	PG/G
02TS-04(0-0.5)-0802	Dioxin TEQ*	4.87	3.9	PG/G

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Field ID	Analyte	Result	Screening Level	Units
02TS-05(0-0.5)-0902	Dioxin TEQ*	203	3.9	PG/G
02TS-05(02-03)-0902	Dioxin TEQ*	111	3.9	PG/G
02TS-05(04-05)-0902**	Dioxin TEQ*	42.1	3.9	PG/G
02TS-07(0-0.5)-0902	Dioxin TEQ*	83.5	3.9	PG/G
02TS-08(0-0.5)-0902	Dioxin TEQ*	33.6	3.9	PG/G
02TS-09(0-0.5)-0802	Dioxin TEQ*	36.1	3.9	PG/G
02TS-09(04-05)-0902**	Dioxin TEQ*	7.27	3.9	PG/G
RA-02SB-01(0-0.5)-0902	Dioxin TEQ*	113	3.9	PG/G
RA-02SB-01(09-10)-0902**	Dioxin TEQ*	45.9	3.9	PG/G
RA-02SB-02(0-0.5)-0902	2,3,7,8-TCDD	5	3.9	PG/G
	Dioxin TEQ*	33.4	3.9	PG/G
RA-02SB-06(0-0.5)-0902	Dioxin TEQ*	39.1	3.9	PG/G
RA-02SB-07(0-0.5)-0902	2,3,7,8-TCDD	4.5	3.9	PG/G
	Dioxin TEQ*	82.2	3.9	PG/G
RA-02SB-09(0-0.5)-0902	Dioxin TEQ*	9.7	3.9	PG/G
RA-02SB-10(0-0.5)-0902	Dioxin TEQ*	16.9	3.9	PG/G
RA-02SB-10(04-05)-0902	Dioxin TEQ*	59.5	3.9	PG/G
Metals				
02TS-01(12-13)-0902	Beryllium	1.2	1.01	MG/KG
RA-02SB-01(0-0.5)-0902	Lead	721	363	MG/KG
TPH				
02SB-01(09-10)-0902**	TPH*	2405.5	200	MG/KG
02SB-04(04-05)-0902	TPH*	3603.2	200	MG/KG
02SB-04(09-10)-0902**	TPH*	2603.8	200	MG/KG
02TS-02(0-0.5)-0802	TPH*	444.8	200	MG/KG
02TS-05(0-0.5)-0902	TPH*	1300	200	MG/KG
02TS-05(02-03)-0902	TPH*	1115	200	MG/KG
02TS-09(0-0.5)-0802	TPH*	250	200	MG/KG

* Value calculated by URS

** Deepest sample from boring

4.3 BUILDING 4

4.3.2 Soil

Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:

Field ID	Analyte	Result	Screening Level	Units
PAHs				
RA-04SB-01(0-0.5)-0902	Benzo(a)anthracene	0.91	0.887	MG/KG
	Benzo(a)pyrene	0.78	0.735	MG/KG
	Benzo(b)fluoranthene	0.92	0.626	MG/KG
	Benzo(g,h,i)perylene	0.52	0.478	MG/KG
	Phenanthrene	1.3	1.04	MG/KG
RA-04SB-06(0-0.5)-0902	Benzo(a)anthracene	1.3	0.887	MG/KG
	Benzo(a)pyrene	0.91	0.735	MG/KG
	Benzo(b)fluoranthene	1.1	0.626	MG/KG
	Benzo(g,h,i)perylene	0.56	0.478	MG/KG
	Indeno(1,2,3-cd)pyrene	0.87	0.62	MG/KG
	Phenanthrene	1.6	1.04	MG/KG
RA-04SB-06B(0-0.5)-0503**	Benzo(a)anthracene	3.6	0.887	MG/KG
	Benzo(a)pyrene	4.1	0.735	MG/KG
	Benzo(b)fluoranthene	4.8	0.626	MG/KG
	Benzo(g,h,i)perylene	3	0.478	MG/KG
	Indeno(1,2,3-cd)pyrene	3.2	0.62	MG/KG
	Phenanthrene	4.4	1.04	MG/KG
RA-04SB-08(04-05)-0902**	Benzo(b)fluoranthene	0.7	0.626	MG/KG
Metals				
RA-04SB-01A(0-0.5)-0902	Beryllium	1.4	1.01	MG/KG
RA-04SB-01A(02-03)-0902**	Beryllium	1.3	1.01	MG/KG
RA-04SB-02(02-03)-0902**	Beryllium	1.9	1.01	MG/KG
RA-04SB-06A(02-03)-0902**	Beryllium	1.3	1.01	MG/KG

** Deepest sample from boring

4.4 BUILDING 5

4.4.2 Soil

Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:

Field ID	Analyte	Result	Screening Level	Units
Pesticides				
RA-05SB-05(0-0.5)-0902	4,4'-DDE	65 J	1.7	MG/KG

Field ID	Analyte	Result	Screening Level	Units
	4,4'-DDT	1100 J	1.7	MG/KG
PAHs				
05SB-01(09-10)-0902**	Benzo(a)anthracene	1.6	0.887	MG/KG
	Benzo(a)pyrene	1.3	0.735	MG/KG
	Benzo(b)fluoranthene	1.7	0.626	MG/KG
	Benzo(g,h,i)perylene	0.87	0.478	MG/KG
	Indeno(1,2,3-cd)pyrene	0.8	0.62	MG/KG
	Phenanthrene	3	1.04	MG/KG
RA-05SB-05(0-0.5)-0902	Benzo(a)anthracene	25 J	0.887	MG/KG
	Benzo(a)pyrene	19 J	0.735	MG/KG
	Benzo(b)fluoranthene	16 J	0.626	MG/KG
	Benzo(g,h,i)perylene	14 J	0.478	MG/KG
	Benzo(k)fluoranthene	19 J	6.2	MG/KG
	Dibenz(a,h)anthracene	7.1 J	0.303	MG/KG
	Indeno(1,2,3-cd)pyrene	11 J	0.62	MG/KG
	Phenanthrene	33 J	1.04	MG/KG
Metals				
RA-05SB-05(0-0.5)-0902	Lead	1790	363	MG/KG

** Deepest sample from boring

4.5 BUILDING 6

4.5.3 Soil

Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:

Field ID	Analyte	Result	Screening Level	Units
Pesticides				
RA-06SB-04(0-0.5)-0902	4,4'-DDT	4	1.7	MG/KG
RA-06SB-04(02-03)-0902**	4,4'-DDT	21	1.7	MG/KG
Metals				
RA-06SB-02(0-0.5)-0902	Mercury	1.5	0.6	MG/KG
RA-06SB-03(0-0.5)-0902	Beryllium	1.6	1.01	MG/KG
RA-06SB-03(02-03)-0902**	Beryllium	1.3	1.01	MG/KG
RA-06SB-04(0-0.5)-0902	Mercury	0.85	0.6	MG/KG
RA-06SB-04(02-03)-0902**	Beryllium	1.1	1.01	MG/KG

Field ID	Analyte	Result	Screening Level	Units
	Mercury	0.92	0.6	MG/KG
RA-06SB-05(0-0.5)-0902	Mercury	0.94	0.6	MG/KG
RA-06SB-09(02-03)-0902**	Beryllium	1.1	1.01	MG/KG
RA-06SB-10(02-03)-0902**	Beryllium	1.3	1.01	MG/KG
RA-06SB-11(0-0.5)-0902	Beryllium	1.1	1.01	MG/KG
RA-06SB-11(02-03)-0902**	Beryllium	1.2	1.01	MG/KG

** Deepest sample from boring

4.6 BUILDING 7

4.6.2 Soil

Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:

Field ID	Analyte	Result	Screening Level	Units
PCBs				
RA-07SB-02(0-0.5)-0902	PCB-1254	0.34	0.22	MG/KG
	Total PCB*	0.34	0.22	MG/KG

Field ID	Analyte	Result	Screening Level	Units
PAHs				
RA-07SB-01(0-0.5)-0902	Benzo(a)anthracene	3.8	0.887	MG/KG
	Benzo(a)pyrene	2.8	0.735	MG/KG
	Benzo(b)fluoranthene	4	0.626	MG/KG
	Benzo(g,h,i)perylene	1.9	0.478	MG/KG
	Indeno(1,2,3-cd)pyrene	1.7	0.62	MG/KG
	Phenanthrene	3	1.04	MG/KG
RA-07SB-02(0-0.5)-0902	Benzo(a)anthracene	2	0.887	MG/KG
	Benzo(a)pyrene	1.6	0.735	MG/KG
	Benzo(b)fluoranthene	2.1	0.626	MG/KG
	Benzo(g,h,i)perylene	1.2	0.478	MG/KG
	Indeno(1,2,3-cd)pyrene	0.97	0.62	MG/KG
	Phenanthrene	2.5	1.04	MG/KG
RA-07SB-03(0-0.5)-0902	Benzo(a)anthracene	1.2	0.887	MG/KG
	Benzo(a)pyrene	0.91	0.735	MG/KG
	Benzo(b)fluoranthene	1.2	0.626	MG/KG
	Benzo(g,h,i)perylene	0.72	0.478	MG/KG
	Indeno(1,2,3-cd)pyrene	0.62	0.62	MG/KG
RA-07SB-04(0-0.5)-0902	Benzo(b)fluoranthene	0.79	0.626	MG/KG
RA-07SB-06(0-0.5)-0902	Benzo(b)fluoranthene	0.7	0.626	MG/KG
	Phenanthrene	1.2	1.04	MG/KG
RA-07SB-07(0-0.5)-0902	Benzo(a)anthracene	0.9	0.887	MG/KG
	Benzo(a)pyrene	0.77	0.735	MG/KG
	Benzo(b)fluoranthene	0.9	0.626	MG/KG
	Benzo(g,h,i)perylene	0.5	0.478	MG/KG
	Phenanthrene	1.2	1.04	MG/KG
RA-07SB-08(0-0.5)-0902	Benzo(b)fluoranthene	0.89	0.626	MG/KG
	Benzo(g,h,i)perylene	0.51	0.478	MG/KG
Metals				
RA-07SB-13(09-10)-0902**	Beryllium	1.3	1.01	MG/KG
RA-07SB-15(0-0.5)-0902	Lead	900	363	MG/KG
RA-07SB-15(04-05)-0902	Beryllium	1.1	1.01	MG/KG

* Value calculated by URS

** Deepest sample from boring

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4.10 RAILROADS

4.10.1 Soil

Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:

Field ID	Analyte	Result	Screening Level	Units
Metals				
RA-RRSB-02(09-10)-0802**	Beryllium	1.3	1.01	MG/KG
TPH				
SRSB-16(06-07)-0902	TPH*	530	200	MG/KG

*Value calculated by URS

** Deepest sample from boring

4.11 ROADWAYS

4.11.1 Soil

Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:

Field ID	Analyte	Result	Screening Level	Units
PAHs				
RA-RDSB-02(09-10)-0802**	Benzo(a)anthracene	1.2	0.887	MG/KG
	Benzo(a)pyrene	1.1	0.735	MG/KG
	Benzo(b)fluoranthene	1.5	0.626	MG/KG
	Benzo(g,h,i)perylene	0.56	0.478	MG/KG
	Phenanthrene	1.6	1.04	MG/KG
Metals				
RA-RDSB-06(04-05)-0802	Beryllium	2	1.01	MG/KG
RA-RDSB-06(09-10)-0802**	Beryllium	1.2	1.01	MG/KG
RA-RDSB-06E(0-0.5)-0802	Beryllium	6.7	1.01	MG/KG
RA-RDSB-06E(04-05)-0802	Beryllium	1.1	1.01	MG/KG
RA-RDSB-06E(09-10)-0802**	Beryllium	1.5	1.01	MG/KG
RA-RDSB-16E(0-0.5)-0802	Antimony	34	31	MG/KG

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4.12 SEWERS

4.12.3 Soil

Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:

Field ID	Analyte	Result	Screening Level	Units
Semivolatiles				
SRSB-30(03-04)-0802	Benzo(a)anthracene	2.6	0.887	MG/KG
	Benzo(a)pyrene	2.1	0.735	MG/KG
	Benzo(b)fluoranthene	2.5	0.626	MG/KG
	Benzo(g,h,i)perylene	1.4	0.478	MG/KG
	Dibenz(a,h)anthracene	0.36	0.303	MG/KG
	Indeno(1,2,3-cd)pyrene	1.4	0.62	MG/KG
	Phenanthrene	4.7	1.04	MG/KG
SRSB-39(10-11)-0503	Phenanthrene	2100	1040	UG/KG
Metals				
SRSB-02(11-12)-0802	Beryllium	1.4	1.01	MG/KG
SRSB-02(16-17)-0802**	Beryllium	1.3	1.01	MG/KG
SRSB-03(12-13)-0802	Beryllium	1.4	1.01	MG/KG
SRSB-03(16-17)-0802**	Beryllium	1.3	1.01	MG/KG
SRSB-05(25-26)-0802**	Beryllium	3.6	1.01	MG/KG
SRSB-06(20-21)-0802	Beryllium	1.4	1.01	MG/KG
SRSB-07(25-26)-0802**	Beryllium	1.8	1.01	MG/KG
SRSB-09(14-15)-0802	Beryllium	1.4	1.01	MG/KG
SRSB-09(18-19)-0802**	Beryllium	3	1.01	MG/KG
SRSB-10(15-16)-0802	Beryllium	1.3	1.01	MG/KG
SRSB-10(17-18)-0802**	Beryllium	1.6	1.01	MG/KG
SRSB-12(25-26)-0802**	Beryllium	1.2	1.01	MG/KG
SRSB-13(19-20)-0802	Beryllium	2.8	1.01	MG/KG
SRSB-13(23-24)-0802**	Beryllium	2	1.01	MG/KG
SRSB-14(25-26)-0802**	Beryllium	1.7	1.01	MG/KG
SRSB-20(23-24)-0902	Beryllium	1.5	1.01	MG/KG
SRSB-26(24-25)-0802**	Beryllium	2.7	1.01	MG/KG
Metals (cont.)				
SRSB-35(24-25)-0503**	Arsenic	20.6	13.2	MG/KG
	Beryllium	1.4	1.01	MG/KG

Field ID	Analyte	Result	Screening Level	Units
SRSB-41(17-18)-0503	Beryllium	1.9	1.01	MG/KG
SRSB-41(21-22)-0503**	Beryllium	1.4	1.01	MG/KG
TPH				
SRSB-16(06-07)-0902	TPH*	530	200	MG/KG
SRSB-18(14-15)-0902	TPH*	550	200	MG/KG
SRSB-19(14-15)-0902	TPH*	600	200	MG/KG

* Value calculated by URS

** Deepest sample from boring

RESPONSE TO COMMENTS
DRAFT SITE-SPECIFIC ENVIRONMENTAL BASELINE SURVEY REPORT FOR ST. LOUIS ARMY AMMUNITION PLANT

Comments from Jim Harris, Missouri Department of Natural Resources, dated November 19, 2003

General Comments

Comment 1. In general the Department found the document difficult to read and grasp the nature and extent of the contamination. In particular it was difficult track what analyses were or were not conducted on particular samples within a particular investigation area. Given the plans to conduct an early transfer, estimates of the quantities of contaminated media and what the levels of the contaminants are would be beneficial.

> **Response:** The Nature and Extent for each Investigation Area are described in **Section 4** with a description of the analytes detected above the Screening Levels including tabulations of the analytical results following the text. The list of analytes for each Investigation Area was developed during the project scoping process and presented in the Final **Field Sampling Plan (FSP) - Part I of the Sampling and Analysis Plan.** The final **FSP** incorporated the approved responses to review comments made by EPA Region VII, (EPA) and the Missouri Department of Natural Resources, (MDNR). **Table 2-3** provides a quick summary of all general analyses categories performed on each sample and **Appendix C** provides a complete listing of all analytical results. Weekly telecons or meetings were held during the field investigations to discuss modifications to the **FSP** and these modifications were documented in **"Appendix B – Meeting Records,"** and essentially all suggested additional characterization samples were collected. The preliminary **Contingency Sampling Program (CSP) FSP Addendum** was developed and presented at a meeting with the MDNR and EPA on January 15, 2003. The **Interim Data Report** was issued on February 27, 2003 and the Final **CSP Addendum to the FSP** was issued on April 1, 2003 after responding to comments issued on the draft documents.
>
> The scope of the SSEBS did not include estimates of the quantities of contaminated media. However, the Baseline Human Health Risk Assessment (Baseline HHRA) evaluates the human health risks associated with the contaminated media including Figure 3-3 indicating "Hot-Spot" locations that were evaluated individually. The Hotspot selection process was defined in the 2nd bullet of **Section 4.3.2** of the Final **FSP**. The 2nd paragraph of **Section 6.2.6** on **page 6-6** will be replaced with the following text paraphrased from **Section 3.3** of the **Baseline HHRA**:
> *A number of potential "hotspots" were evaluated as part of the SSEBS. Potential "hotspots" are relatively small areas where known or suspected releases may have occurred. Examples include stained soils under machinery, locations where the Comprehensive EBS found chemicals present above screening levels or areas where chemicals were reportedly handled but where no data exists. These hotspot areas typically cover a small fraction of the area covered by the building or investigation area with which they are associated. For purposes of the risk assessment, all soil data*

RESPONSE TO COMMENTS
DRAFT SITE-SPECIFIC ENVIRONMENTAL BASELINE SURVEY REPORT FOR
ST. LOUIS ARMY AMMUNITION PLANT

Comments from Jim Harris, Missouri Department of Natural Resources, dated November 19, 2003

collected from the 0-10 foot bgs interval during the SSEBS, including those designated as "risk assessment samples" in the FSP will be included in the hotspot evaluation. "Hotspots" are defined as discrete areas of contamination where one or more chemicals are present at concentrations above screening levels (e.g., "exceedances"). A hotspot could consist of one or more samples. In the event that adjacent samples showed exceedances, they were pooled as a single hotspot. Samples with no exceedances were used to identify the boundaries of the hotspots, and will not be included in the hotspot dataset when calculating risks. A summary of the individual hotspots to be evaluated in the Baseline HHRA is presented in **Table 6-1** *and shown on* **Figure 6-1.**

Table 6-1 and **Figure 6-1** will be added to the SSEBS and are the same as **Table 3-1** and **Figure 3-3** of the **Baseline HHRA.**

Comment 2. Section 0.4.1, Concrete: The Department believes the PCB contaminated concrete should be included in the risk assessment since a future owner may utilize those buildings that have PCB contamination and the risks that could pose should be evaluated.

Response: According to the last paragraph of **Section 3.2** of the **Baseline HHRA**: *Several buildings currently on-site are likely to contain some level of contamination. Current risk assessment protocols cannot accurately estimate risks associated with chemicals on the walls and floors of buildings. The potential acceptability of contamination in the building related materials are evaluated based on comparisons to standards for lead, asbestos and PCBs. A discussion of potential human exposure to contaminated building material, as described above, is included in this HHRA (Section 5.2.14). From a risk perspective, it should be noted that the buildings are not occupied at this time, nor are they likely to be occupied in the future without requiring substantial renovation first. Such renovation (e.g., cleaning, painting, wall partitions, new flooring, active ventilation system, etc.) would undoubtedly reduce or eliminate potential exposure to any residuals on the building materials.*

According to the 1st paragraph of **Section 5.2.14** of the **Baseline HHRA**: *As discussed in Section 3.2, buildings on-site may contain contaminants, such as lead, PCBs or asbestos. Risks associated with such materials cannot be readily quantified using standard risk assessment protocols; however, as discussed below, they have been evaluated to some extent as part of the SSEBS.*

PCBs, asbestos and lead-based paint are all believed to be present at concentrations exceeding regulatory action levels on multiple building surfaces across the Site. PCBs

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have been detected in excess of action levels in wipe samples from buildings 1, 4 and 5, and above the CALM (MDNR, 2001) in concrete samples from Building 2.

The first bullet under the Concrete bullet in **Section 0.4.1** of the SSEBS will be revised to read:
Polychlorinated biphenyls (PCBs) were detected in 76% of the concrete samples collected Site-wide, however only one sample in the northwest corner of Building 2 had a concentration above the screening level. Because Risks associated with concrete surfaces cannot be readily quantified using standard risk assessment protocols, concrete contamination will not be addressed quantitatively in the Baseline HHRA. Depending on the future uses of the Site, additional studies may be warranted to define the extent of PCB-contaminated concrete in Building 2 to either remove or isolate the area of contaminated material.

Comment 3. Section 0.4.2, Sewer System: Although samples were collected near sewer lines, no samples were collected immediately beneath sewer lines. During the removal of Building 3 it was noted that a contamination zone was located immediately below the sewer lines with little lateral migration. Further work may be necessary to thoroughly evaluate contamination around the sewers.

Response: During the Building 3 removal it was also noted that there was little vertical migration from the contamination immediately below the sewer lines. The difficulty associated with the sampling of the soils directly under the sewers was discussed during the workplan review meeting on February 20, 2002. Because it was not feasible to collect samples immediately beneath sewer lines, the Final **FSP** specified that samples be collected adjacent to the sewer lines so as not to disrupt their integrity, but at 3 depth intervals, 0-0.5, 4-5 and 9-10 below the bottom of the sewers. The 0-0.5 ft. sample was actually taken from 0-1 ft. to obtain sufficient sample. Several of the deeper samples were not collected due to refusal being encountered before these depths could be achieved, however where possible, a sample was collected at the depth immediately above refusal. In accordance with the **CSP Addendum,** 10 soil borings were sampled during the **CSP** to evaluate potential releases in the vicinity of breaches identified during the TV survey of the sewers. Six additional soil borings were sampled to evaluate the extent of TPH and PAH contamination in the vicinity of two soil borings. These 27 samples were in addition to the initial 89 samples collected in 24 soil borings at approximately 150-ft. intervals, (See **Section 2.13.3**). The following sewer wastewater or sediment contaminants were detected in their respective nearby soil borings at concentrations above the Screening Levels: 1 arsenic sample, 6 PAHs in 1 sample and 1

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PAH in another sample, and TPH in 3 samples. This characterization is complete for the purpose of the **SSEBS**.

The following sentence will replace the last sentence at the end of this Section:
Based on the analysis of the data collected for the SSEBS, all data have been collected to characterize the nature and extent of contamination in all of the Investigation Areas in accordance with the FSP. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of localized contamination in, and directly beneath, the sewer system and sewer trenches. The vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring.

Comment 4. Section 0.4.3, Soils: As the Department commented previously, the arbitrary termination of soil borings at ten feet in depth may address exposure but it does facilitate full characterization of soil contamination. Additional work may necessary to completely define nature and extent in soils.

> **Response:** See **Responses to Comments 3 & 11.** The sampling depth was actually the listed interval below the top of the ground surface below any floors/pavements and sub base material, which in many cases was substantially deeper than 10 ft below grade due to the depths of trenches and basement floors investigated. The 10-ft. depth was developed during the project scoping process, based on the data uses for the risk assessment and estimation of the extent of contamination. The basis for the Risk Assessment sample depths was due to the lack of any exposure pathway at depths greater than 10 ft. below grade, the typical depth of utility excavations. The Final **FSP** incorporated the approved responses to review comments made by EPA and MDNR.
>
> The following sentence will be added at the end of this Section:
> "Depending on the future uses of the Site, additional studies may be required in borings where contamination exceeded the Screening Levels in the deepest sample from that boring."

Comment 5. Section 0.4.4, Groundwater: Since only one round of sampling has been conducted, additional groundwater data and aquifer studies will be necessary before definite conclusions can be drawn.

> **Response:** The groundwater characterization was completed in accordance with the Final **FSP.** (See **Page 1** of **Table 3-1, Site-Wide Location/Groundwater**). The findings and conclusions from the SSEBS were consistent with the previous **Comprehensive EBS**

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that included two rounds of groundwater sampling in 1999 from the 9 previously installed wells. The new wells installed during the **SSEBS** did not encounter any water-bearing unit during their installation, and the results of the groundwater sampling during rainfall events indicated the only contaminants above the Screening Levels were PAHs that were possibly due to particulates in the turbid water sample. Depending on the future uses of the Site, additional groundwater studies may be warranted in the future in support of specific uses of the property.

The following sentence will be added at the end of this Section:
"Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of localized contamination in the groundwater."

Comment 6. Section 0.4.4, Groundwater, second bullet: Were PAHs detected in any of the soil samples collected during the monitoring well installations? Why weren't the groundwater samples filter before analysis if turbidity was an issue?

Response: Comment noted. According to **Section 5.3, Page 5-5** of the Final **FSP**, soil sampling was not planned for the groundwater monitoring well soil borings.

The August 25, 2002 weekly teleconference notes (see **Appendix B**) included the following:
For Discussion. In monitoring well 08MW-02 (which is within the boundaries of the former fuel storage area), an area of visually impacted soil was encountered from a depth of about 9-14 feet bgs. No sample was collected from the boring because soil sampling was not included in the FSP for the monitoring well borings and the depth is at, or slightly deeper than, the depth of the risk assessment samples (9-10 ft. bgs.)
Response: It was decided that if this impacted material is encountered in the borings surrounding this location, then it would be sampled. If this impacted material is not encountered in the surrounding boring locations, then another Geoprobe boring will be done next to 08MW-02, in order to collect a sample of this impacted material.

Based on the field investigations one additional boring (08SB-MW02) was advanced adjacent to monitoring well 08MW-02 because impacted soil was observed at this location during well installation. A soil sample was collected from this boring in the impacted depth (11 to 13 feet bgs) and analyzed for TPH. However, PAHs were not included in the analyte list for these samples. **Section 4.7.2** provides a summary of the PAH detections above the Screening Levels in soil sample RA-08SB-06(04-05)-0902 approximately 40 feet northeast of 08MW-02. For the other monitoring wells, there were no PAHs detected above the Screening Levels in the nearest samples:

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RA-RDSB-15E approximately 40 feet northwest of 03MW-01, RA-RDSB-01 approximately 20 feet north of 08MW-01, RA-08SB-17 or RA-08SB-18, approximately 40 feet northwest, and 25 feet northeast of 08MW-01, respectively.

The groundwater monitoring well samples were collected after development of the wells in accordance with **Section 5.3.2 and 5.3.3** of the Final **FSP**, which did not include filtration. PAH data from filtered groundwater samples would not be useable in the **Baseline HHRA**. Groundwater sampling protocol for potable water supplies may include filtration of metals, however this protocol was not included in the Final **FSP** because the perched groundwater was not being evaluated as a drinking water source.

Comment 7. Section 0.4.5: The Department believes additional investigation will be needed to define the full vertical extent of soil contamination, contamination beneath sewers and gain a better understanding of the groundwater.

> **Response:** See **Responses to Comments 3, 4 and 5**. The text will be revised to read:
> *Based on the analysis of the data collected for the SSEBS, all data have been collected to characterize the nature and extent of contamination in all of the Investigation Areas in accordance with the FSP to satisfy the SSEBS and Baseline HHRA in support of the FOSET process. For each Investigation Area, the type, location and number of samples collected meets the Data Quality Objectives defined in Section 3 of the FSP. Depending on the future uses of the Site and the risk management decisions, additional studies may be warranted to further evaluate the possibility of contamination in the following areas:*
> - *PCB-contaminated concrete in Buildings 1, 2, 4 & 5*
> - *Localized contamination in, and directly beneath, the sewer system and sewer trenches*
> - *The vertical extent of contamination in borings where contamination exceeded the Screening Levels in the deepest sample from that boring.*
> - *Asbestos and lead-based paint contamination throughout the buildings*
> - *Waste characterization prior to waste disposal*
> - *Characterization of potential contamination below the deadman pads for the former Building 10 USTs*

Comment 8. Section 0.4.6: Given the site will be redeveloped the Department believes the risks to utility workers working on or removing sewer lines should be evaluated.

> **Response:** Comment noted. See **Response to Comments 3 and 7**. All Risk Assessment samples were collected in accordance with the Final FSP in the 1st paragraph

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of **Section 3.2** on **Pages 3-4 & 5** and the last paragraph of **Section 4.2 on Pages 4-1 & 2** setting the maximum depth of the Risk Assessment samples at 10 ft. below ground surface. The 3rd bullet on **Page 4-5** of the Final **FSP** presents the Future Excavation/Construction Worker receptor population. The 10-ft. depth trench is representative of routine utility excavations, and the adoption of a deeper trench scenario would not be standard practice. If a deeper trench scenario were used, the deeper samples would dilute the shallower samples yielding a less conservative risk estimate. Characterization samples were collected at depths greater than this, but they were not included in the risk assessment calculations.

Comment 9. Section 1: Additional historical research needs to be conducted to determine where the PCE, TCE and carbon tetrachloride were used in the SLOP/SLAAP manufacturing process.

Response: Comment noted. The historical research conducted during the **Comprehensive EBS** concluded that a variety of solvents were used during the manufacturing operations at the Site. These findings are described in detail in the **Comprehensive EBS** and the Final **FSP**, and summarized in **Section 1 and Table 1-1 through 1-11** of the **SSEBS Report**. Additional historical research was not included in the SSEBS phase and further studies are not warranted based on the limited detections found during the extensive sampling of all media at the Site as indicated below.

As summarized in **Table 4-5**, the data from the SSEBS investigations indicate that none of these compounds were commonly found at the Site, and only Carbon Tetrachloride was detected above the Screening Level in one sample from the environmental samples (excluding sewer sediments and wastewater):
PCE:
> 0 detection in 13 groundwater samples
> 4 detections in 6 sewer sediment samples with none above the Screening Level
> 2 detections in 547 soil samples with none above the Screening Level
> 1 detection in 10 sewer wastewater samples which was not above the Screening Level
TCE:
> 0 detection in 13 groundwater samples
> 4 detections in 6 sewer sediment samples with 2 above the "soil" Screening Level
> 2 detections in 547 soil samples with none above the Screening Level
> 1 detection in 10 sewer wastewater samples, which was also above the "water" Screening Level
Carbon tetrachloride:

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1 detection in 13 groundwater samples, which was also above the Screening Level in 02MW-01

0 detections in 6 sewer sediment samples

0 detections in 547 soil samples with none above the Screening Level

1 detection in 10 sewer wastewater samples

Comment 10. Section 1.3.1: The Department requests the Army provide a copy of the USATHMA, 1979 report.

Response: A copy will be provided.

Comment 11. Section 2: If the sample collected from the deepest prescribed depth exceeded a screening level were additional samples collected from a deeper depth? If no, why not?

Response: The initial agreed upon planning effort did not contain provisions in the Final **FSP** or the **CSP Addendum** for collecting contingency samples at depths deeper than specified in the Final **FSP**. (See **Response to Comment 4** for additional discussion of the depth of samples collected. Also see **Response to Comment 8** regarding evaluation of potential risks to the Future Excavation/Construction Worker receptor population which limited our Risk Assessment samples to depths of 10 feet below ground surface.)

However, as indicated below in the 3rd to last sentence of **Section 5.2** of the final **FSP**: "In any boring where visual observation indicates a region of higher contamination is possible, additional samples from that region will be collected."

For example, as indicated in **Section 2.9.1**, a discretionary sample was collected in boring 10SB-01 from a thin layer of visually impacted soil approximately 5 feet below the specified depth.

There were 40 soil borings with contamination in the deepest sample exceeding one or more Screening Levels. Of these exceedances, 22 were only related to beryllium, which is suspected to be a natural constituent of the clay found in the deeper soils at the Site. To clarify the extent of the **SSEBS** investigations, the following sentence will be included before the tables that show the soil boring sample results in **Section 4-Nature and Extent** for each Investigation Area where this occurred:

"Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:"

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(See Attached **Section 4 Table Revisions** showing the introductory paragraph and the revised tables with "******" indicating all the exceedances in the deepest samples)

Section 0-Executive Summary and **Section 6-Summary and Conclusions** will be revised to include similar statements about the possible need for future studies depending on the future uses of the Site.

Comment 12. Section 2, page 2-1, second paragraph: Was a PID used to field screen the soil cores as they were removed from the liners? If so, were the soil samples collected from the interval exhibiting the highest readings or the prescribed depth?

> **Response**: Comment noted. Soil-boring samples were collected in accordance with **Section 5.2** of the Final **FSP** that did not include screening of the soil-boring cores with a PID prior to designating the samples to be analyzed. After discovering soils with visible oil staining and odors in the vicinity of Building 8, a PID was used in an attempt to identify additional discretionary soil samples for analyses. No detections were measured with the PID, but discretionary samples were collected from areas with visible staining, as indicated in the **Response to Comment 11**.

Comment 13. Section 2.2.4, first paragraph: Why weren't samples collected from all borings and test pits analyzed for TPH and SVOCs? Hydraulic oil and heating oil were widely used throughout the building?

> **Response**: Comment noted. The analytical protocol was defined in **Tables 3-1 & 3-3** of the Final **FSP**, in accordance with historical knowledge available at the time based on the research conducted during the **Comprehensive EBS** and as discussed during the workplan development conferences. All trench samples in Building 2 were analyzed for TPH-DRO & -GRO. In addition to these samples, up to 3 samples from all of the 12 Risk-Assessment soil borings were analyzed for PAHs and VOCs, which include the toxic constituents of TPH compounds, and 3 samples from 4 other soil borings were analyzed for TPH-DRO & ---GRO in accordance with the Final **FSP**.

Comment 14. Section 2.4.2, last paragraph: Why were only specific PAHs analyses conducted? Why not run the full suite of PAHs when using method 8270?

> **Response**: Based on the findings of the initial sampling event, the PAH analyses performed during the **CSP** for Building 4 were limited to those indicated in **Table 1** of the Final **CSP Addendum to the FSP**. The 3rd sentence on **Page 2-8 of Section 2.4.2** will be revised to read:

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> *The remaining two borings (RA-04SB-06B and RA-04SB-08A) were located outside of the building foundation as offsets for samples collected during the initial sampling event which had concentrations of the following PAH compounds above the screening levels: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, and phenanthrene in boring RA-04SB-06B and benzo(b)fluoranthene in boring RA-04SB-08A. One sample was collected from RA-04SB-06B off the west edge of the roadway west of Building 4 from 0 to 0.5 feet bgs using the Geoprobe® rig. This sample was analyzed for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, and phenanthrene (PAHs). Boring RA-04SB-08A was located south of Building 4 with one sample collected from 4 to 5 feet bgs and analyzed for benzo(b)fluoranthene (PAH).*

Comment 15. How large an area was not sampled/evaluated since samples RA-06SB-08 and RA-06SB-16 were not collected? How does the Army plan to address this data gap?

> **Response:** There were no contaminants detected above the Screening Levels in samples RA-06SB-06 and RA-06SB-14, and RA-06SB-07 and RA-06SB-15, the samples approximately 60 and 30 feet west of samples RA-06SB-08 and RA-06SB-16, respectively. Samples RA-06SB-08 and RA-06SB-16 were to be located approximately 5 feet west of the eastern wall, so the maximum area would be approximately 20 feet by 40 feet.
>
> There is no appreciable data gap because the area is minimal and is inaccessible and covered by an existing structure. The drawings will be modified to indicate the approximate location of the wall encountered during the field investigations. Also note that in the **Baseline HHRA** risks are based on the 95% upper confidence level of the data, which yields more conservative results when fewer data points are used.
>
> The following sentence will be added to the 1st paragraph of **Section 4.5.3** on **Page 4-11**: "Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of pesticide contamination in soils east of the partition wall."

Comment 16. **Section 2.8:** The Department would have preferred TPH and PAH analysis on all the samples collected from Building 8 due to the fuel oil storage.

> **Response:** Comment noted. The Final **FSP** analytical protocol was based on the historical research conducted during the **Comprehensive EBS** and the workplan development conference. All analyses were performed in accordance with the Final **FSP** analytical protocol described on **Page 4** of **Table 3-1** and **Page 7** of **Table 3-3**. This

included 25 TPH samples from 10 different characterization borings plus 1 discretionary sample collected from a Risk Assessment boring. There were also 62 PAH and VOC samples from 21 risk assessment borings. TPH was not included on the analyte list for the Risk Assessment samples because TPH cannot be quantitatively evaluated in the **HHRA**, however the toxic components of the TPH compounds were analyzed. TPH analyses was added to the discretionary sample collected from a Risk Assessment boring due to the presence of visible oil staining and petroleum odors. Additional PAH samples were not included in the Final **FSP** as stated on **Page 4** of **Table 3-1** in the Building 8 and 8A location because the "Extent of SVOC contamination has been assessed as part of the **Comprehensive EBS** and no further characterization appears warranted." The following additional borings were sampled in the vicinity of Building 8, including: 08SB-MW02 which was advanced adjacent to monitoring well 08MW-02 because impacted soil was observed at this location during well installation. A soil sample was collected from this boring in the impacted depth (11 to 13 feet bgs) and analyzed for TPH.

SRSB-25 was co-located with RA-08SB-17 and 3 samples from this boring were therefore analyzed for TPH

In addition to these samples designated for the characterization and risk assessment of Building 8, two of the westernmost samples for the Northeast Parking Area are (RA-NESB-01 and RA-NESB-04) which were approximately 20 feet east of the former Building 8 and included 6 PAH samples.and VOC samples that include the toxic constituents of TPH compounds.

Comment 17. Section 2.8.2, second paragraph: The Department would have preferred TPH analysis be performed on the risk assessment samples collected since the site stored fuel oil and the data would have helped characterize the site. The Department does consider TPH a risk and the data would have been beneficial when plans to remediate the site are developed.

Response: Comment noted. See **Responses to Comments 1 and 16**.

Comment 18. Section 2.9: Given the quench oil tanks stored heavy hydrocarbons, PAH analysis should have been conducted. In addition, PCB analysis should have been conducted since the machining process used PCB containing oil and may have contaminated the quench oil with PCBs.

Response: The Final **FSP** analytical protocol was based on the historical research conducted during the **Comprehensive EBS** and the workplan development conference.

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All sampling and analyses were performed in accordance with the Final **FSP** as described on **Page 4** of **Table 3-1** and **page 7** of **Table 3-3**. However, after review of **Response to MDNR Comment 46** on the Draft **FSP**, the additional four-five borings were not included in the Final **FSP** beneath the former UST deadman pad and therefore the SVOCs, PCBs and VOCs analyses were not included in the Final **FSP** for these samples

In addition to the Building 10 samples, additional samples were collected in the proximity of the former Building 10 Investigation Area from the Roadway Risk Assessment borings RA-RDSB-13, -13E & -14. These 9 samples were analyzed for PAHs, PCBs and VOCs, (in addition to the other Risk Assessment Parameters) with no detections above the Screening Levels.

The following text will be added to Section 4.8.1 after the table:
In addition to the Building 10 samples, additional samples were collected in the proximity of the former Building 10 Investigation Area from the Roadway Risk Assessment borings RA-RDSB-13, -13E & -14. These 9 samples were analyzed for heavy metals, PAHs, PCBs and VOCs, with no detections above the Screening Levels. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of releases from these former USTs.

Comment 19. Sections 2.11, 2.12 and 2.13: Additional samples may be needed to further evaluate the railroad, roads and sewers given the 150-foot sampling interval.

Response: Comment noted, but without more specific listing of suspected data gaps, a specific response is not possible. See **Response to Comment 1**. All analyses were performed in accordance with the Final **FSP** analytical protocol described on **Page 1** of **Table 3-1** and **Pages 8 through 12 of Table 3-3**. In addition, during the CSP the following samples were collected to define the extent of contamination:
- 4 samples collected from 4 Railroad soil borings,
- 7 samples collected from 7 Roadway soil borings, and
- 27 Sewer soil samples collected from 10 soil borings at potential sewer breaches and 6 areas requiring further extent data.

As indicated on **Figure 2-1**, there is overlap of sample locations in these Investigation Areas from the adjacent Buildings, Roadways and Railroads investigation areas providing additional characterization of the Site and evaluation of the risks.

The following text will be added after the tables to **Sections 4.10.1, 4.11.1 & 4.12.3:**
"Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of additional contamination in these areas."

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Comment 20. Section 2.14, third paragraph: If turbidity was an issue, why weren't the samples filtered prior to analysis?

> **Response**: Comment noted. See response **Response to Comment 6**.

Comment 21. Section 4: The addition of maps indicating (highlighting) the location of contaminated samples and the extent of the plumes would assist in understanding the nature and extent.

> **Response**: The locations are described in **Section 4**, and **Figure 3-3** – Site-Wide Hotspot Locations, is included in the **Baseline HHRA**. **Table 6-1** and **Figure 6-1** will be added to the SSEBS and are the same as **Table 3-1** and **Figure 3-3** of the Baseline HHRA.

Comment 22. Section 4.1: Since hydraulic oil was used in Building 1, why weren't TPH analyses conducted?

> **Response**: Comment noted. In the Building 1 Investigation Area, there were 15 TPH samples collected from 6 Characterization soil borings with no detections above the Screening Levels, therefore there is no TPH discussion in this Section. (See **Tables 2-3 and 4-6 and Appendix C**). The Final FSP analytical protocol did not include TPH analyses for the Risk Assessment samples because these data could not be quantitatively used in the Risk Assessment, however the toxic components of the TPH compounds were analyzed as PAHs and VOCs. There were 33 PAH and VOC samples collected from 11 Risk Assessment soil borings with no VOC detections above the Screening Levels. The PAH results of the 2 samples with detections above the Screening Level are presented in this Section. In addition to these samples collected as part of the Building 1 Investigation Area, 3 samples were collected and analyzed for SVOCs and TPH from the Sewer soil boring SRSB-06 located immediately to the south of Building 1. As indicated in **Section 4.12.3** there were no SVOC or TPH detections in these samples above the Screening Levels.

Comment 23. Section 4.1.2, fourth paragraph: The Department wasn't aware EPA remedial investigation guidance used process knowledge to define the extent contamination.

> **Response**: The last sentences will be revised to read:
> *The northern and southern extents of contamination are not defined and may extend beyond the former billet yard, however process knowledge suggests that metal contamination from storage of steel billets is not expected to extend beyond the edges of*

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the former billet yard. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of additional copper contamination in this area.

Comment 24. Section 4.4.2, second paragraph, last two sentences: After reading these sentences the Department had no idea where the plume was. Wouldn't a sample starting 06SB be for Building 6? How did the plume know to stop at the south property line? How is the eastern extent of the plume defined by the hillside south of the building?

> **Response:** The SSEBS effort did not plan for or implement sample collection/analysis to assist in the characterization of off-site contamination. The last sentences will be revised as follows:
> *The PAH contamination below the oil storage pad is defined by samples from boring locations 06SB-01 on the west and RA-RDSB-10E on the northwest, and may extend to the property boundary to the south and along the entire hillside south of Building 5, but could extend further. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of additional PAH contamination in this area.*

Comment 25. Section 4.5.2: Although no guidance may exist for evaluating risk, guidance is available to determine if a duct with these contaminants present is a hazardous waste.

> **Response:** Comment noted. All analyses were performed in accordance with the Final **FSP** analytical protocol described on **Page 3** of **Table 3-1** and **Page 5** of **Table 3-3**. There was no indication of additional contingency sampling required during development and approval of the **CSP FSP Addendum**. If, during future remodeling or demolition activities, there is sufficient quantity of material in the ducts to require the handling of this material as a hazardous waste, then Toxicity Characterization sampling and analyses would be required before this material could be transported for disposal. Waste management recommendations are not within the scope of this document.

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Comment 26. Section 4.6.2, fourth paragraph: The Department does not believe a contaminant knows to stop migrating once it reaches a property boundary. Does the Army have data to confirm the release stops at the boundary? If no, then nature and extent has not been defined and this must be stated.

> **Response:** The SSEBS effort did not plan for or implement sample collection/analysis to assist in the characterization of off-site contamination. The last sentences of the 2nd paragraph will be revised as follows:
> *The extent of contamination is defined by samples from adjacent boring locations RA-07SB-11, RA-07SB-14 and RA-07SB-16, and may extend to the property boundary to the south, but could extend further. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of additional contamination in this area.*

Comment 27. Section 4.8.1: Given the material stored and how it was used the Department believes SVOC and PCB analyses should have been conducted on soil samples from Building 10.

> **Response:** Comment noted. See **Response to Comment 18**. All analyses were performed in accordance with the approved Final **FSP** for Building 10. Although these analyses were not included in the Final **FSP**, future investigations may need to consider analysis for these contaminants.

Comment 28. Section 4.10.1: This section discusses TPH results, however the table on page 0-2 states no TPH analysis was conducted. What samples were analyzed for TPH?

> **Response:** The table summarizing the results for the Railroads Investigation Area is correct on **Page 0-2**. The 1st two sentences of the 4th paragraph of **Section 4.10.1** will be revised to read:
> "TPH-DRO was not analyzed in any of the railroad soil samples. However TPH-DRO was detected above the Screening Level in one sewer soil sample, SRSB-16(06-07)-0902, in close proximity to the railroad line southeast of Building 1."

Comment 29. Section 4.12.1: What activities at the site or compounds used there could be responsible for the compounds found in the sewer sediments?

> **Response:** Comment noted. The sewers are collection vessels for all site-wide stormwater, as well as process drainage from production operations and toilet/hand-washing sources. Based on the findings of contaminated surface soils throughout the

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Site, these sediments could be due to sediment/waste runoff from any of these wastewater streams. **Tables 1-1 through 1-11** provide a summary of the physical features of each process building including hazardous material information. **Table 2-1** provides a summary of potential contaminants in each Investigation Area. **Section 1.4** provides a detailed description of the processes employed at the Site with a listing of process equipment which included welding machines; machine, electrical, and carpenter shops; and a small automotive shop. A self-contained liquid storage area was located on the first floor of Building 3 that stored various oils, solvents, and chemicals. **Pages 1-13 and 1-14** provide a detailed inventory of these liquids, including various oils, greases, and process fluids.

Comment 30. Section 4.12.2: What activities at the site or compounds used there could be responsible for the compounds found in the wastewater?

> **Response**: Comment noted. See response**Response to Comment 29**.

Comment 31. Section 5.1.3: As stated previously, earlier work at the site found releases from the sewers did not spread laterally but remained immediately beneath the sewer line. This study did not investigate this area and definite conclusions regarding releases from the sewer cannot be made.

> **Response**: See **Response to Comment 3**. The soil immediately beneath the sewer lines was not investigated during the **SSEBS**. However soil samples were collected at designated depths near and beneath the sewer lines according to the agreed Final **FSP** and Final **CSP Addendum**. **Section 5.1.3** states that:
> "Since these results indicate that arsenic is more of a Site-wide and background constituent, the sewer breaches do not appear to be allowing measurable amounts of contamination from the sewer sediment and wastewater to exit the sewer system into the Site soil and groundwater."
>
> Although there may be some isolated pockets of contamination contained within the sewer trenches, there is no evidence to suggest that this contamination has been released into surrounding soils or groundwater that would provide a pathway to humans other than those that were evaluated in the **Baseline HHRA**.
>
> The following sentence will be added to this Section:
> "Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of localized contamination in, and directly beneath, the sewer system and sewer trenches."

Comments from Jim Harris, Missouri Department of Natural Resources, dated November 19, 2003

Comment 32. Section 5.2: Although the contaminants found in the sewer are unique, they still present a risk to utility workers and the sewer district may be concerned about the discharge of these compounds in their sewer system.

> **Response:** Comment noted. See **Response to Comment 31.** The 2nd paragraph states that "Contaminants found in the sewer system present a unique situation." The intent was not to indicate that the "contaminants" were unique.

> A copy of the Draft **SSEBS** has been provided to the City of St. Louis.

Comment 33. Section 6.1: How does this section address nature and extent? There is no discussion of contaminate levels found in particular areas, location/distribution or the volume of contaminated media.

> **Response:** See **Response to Comment 21.** As stated in the 1st paragraph, "This section presents a brief summary of the findings of the nature and extent of contamination for all media at the Site." The contaminant levels are compared to the Screening Levels. The specific locations are described in detail in **Section 5** and there was no intent to estimate the volume of contaminated media, as this would be conducted during follow-on activities after evaluation of the risks and the establishment of remediation goals by risk managers.

> The locations are described in **Section 4**, and **Figure 3-3** – Site-Wide Hotspot Locations, is included in the **Baseline HHRA**. **Table 6-1** and **Figure 6-1** will be added to the SSEBS and are the same as **Table 3-1** and **Figure 3-3** of the Baseline HHRA.

Comment 34. Section 6.2.1, Concrete: The Department believes PCB contaminated concrete does present a human health risk to workers and should be evaluated in the risk assessment. This is particularly true if the PCBs are co-located with dioxins.

> **Response:** See **Response to Comment 2.** The first bullet will be revised to read:
> *Because Risks associated with concrete surfaces cannot be readily quantified using standard risk assessment protocols, concrete contamination will not be addressed quantitatively in the Baseline HHRA. Depending on the future uses of the Site additional studies may be warranted to define the extent of PCB-contaminated concrete in Building 2 to either remove or isolate the area of contaminated material.*

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Comment 35. Section 6.2.2: The Department will expect further evaluation of the contamination found in the sewers and may require remediation be conducted.

> **Response**: Comment noted. See **Responses to Comments 3, 8, 19, 31 & 32.** The last sentences of this Section will be revised to read:
> "At this time, no further characterization data is required. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of localized contamination in, and directly beneath, the sewer system and sewer trenches."

Comment 36. Section 6.2.3: The risks posed by all contaminants regardless of depth must be evaluated and then an appropriate remedial response determined.

> **Response**: Comment noted. See **Responses to Comments 4 & 8.** The following sentence will be added to this Section:
> "Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring."

Comment 37. Section 6.2.5: The Department does not concur that no additional work is needed. The full nature and extent of releases has not and cannot be evaluated when subsurface borings are arbitrarily terminated at 10 feet and no risk assessments are conducted for soil data collected below 10 feet. In addition, one groundwater-sampling event is not sufficient to say groundwater has been fully characterized.

> **Response**: See **Responses to Comments 3 and 7.** The text will be revised to read:
> *Based on the analysis of the data collected for the SSEBS, all data have been collected to characterize the nature and extent of contamination in all of the Investigation Areas in accordance with the FSP to satisfy the SSEBS and Baseline HHRA in support of the FOSET process. For each Investigation Area, the type, location and number of samples collected meets the Data Quality Objectives defined in Section 3 of the FSP. Depending on the future uses of the Site and the risk management decisions, additional studies may be warranted to further evaluate the possibility of contamination in the following areas:*
> - *PCB-contaminated concrete in Buildings 1, 2, 4 & 5*
> - *Localized contamination in, and directly beneath, the sewer system and sewer trenches*
> - *The vertical extent of contamination in borings where contamination exceeded the Screening Levels in the deepest sample from that boring.*
> - *Asbestos and lead-based paint contamination throughout the buildings*

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- *Waste characterization prior to waste disposal*
- *Characterization of potential contamination below the deadman pads for the former Building 10 USTs*

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SPECIFIC COMMENTS

Comment 1. Section 0.3, page 0-1. The second bullet item refers to the media investigated in Building 2. Structural steel was also "swipe" sampled.

> **Response:** Comment noted. There were no structural steel "swipe" or wipe samples collected during the **SSEBS** field investigations.

Comment 2. Section 0.4.1, Building Materials and Product Samples, page 0-3. The second bullet item states that polychlorinated biphenyl (PCB) concrete contamination will not be addressed in the Baseline Human Health Risk Assessment (HHRA). It is unclear why PCB-contaminated concrete will not be examined as an exposure pathway in the HHRA. Revise the text to include a complete and defensible rationale for not addressing PCB-contaminated concrete in the HHRA.

> **Response:** According to the last paragraph of **Section 3.2** of the **Baseline HHRA**: *Several buildings currently on-site are likely to contain some level of contamination. Current risk assessment protocols cannot accurately estimate risks associated with chemicals on the walls and floors of buildings. The potential acceptability of contamination in the building related materials are evaluated based on comparisons to standards for lead, asbestos and PCBs. A discussion of potential human exposure to contaminated building material, as described above, is included in this HHRA (**Section 5.2.14**). From a risk perspective, it should be noted that the buildings are not occupied at this time, nor are they likely to be occupied in the future without requiring substantial renovation first. Such renovation (e.g., cleaning, painting, wall partitions, new flooring, active ventilation system, etc.) would undoubtedly reduce or eliminate potential exposure to any residuals on the building materials.*
>
> According to the 1st paragraph of **Section 5.2.14** of the **Baseline HHRA**: *As discussed in **Section 3.2**, buildings on-site may contain contaminants, such as lead, PCBs or asbestos. Risks associated with such materials cannot be readily quantified using standard risk assessment protocols; however, as discussed below, they have been evaluated to some extent as part of the SSEBS.*
>
> *PCBs, asbestos and lead-based paint are all believed to be present at concentrations exceeding regulatory action levels on multiple building surfaces across the Site. PCBs have been detected in excess of action levels in wipe samples from buildings 1, 4 and 5, and above the CALM (MDNR, 2001) in concrete samples from Building 2.*

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The first bullet under the Concrete bullet in **Section 0.4.1** of the **SSEBS** will be revised to read:
Polychlorinated biphenyls (PCBs) were detected in 76% of the concrete samples collected Site-wide, however only one sample in the northwest corner of Building 2 had a concentration above the screening level. Because Risks associated with concrete surfaces cannot be readily quantified using standard risk assessment protocols, concrete contamination will not be addressed quantitatively in the Baseline HHRA. Depending on the future uses of the Site, additional studies may be warranted to define the extent of PCB-contaminated concrete in Building 2 to either remove or isolate the area of contaminated material.

Comment 3. Section 0.4.2, Sewer System, page 0-4. This section states that numerous contaminants, including dioxins, were detected in sediment and wastewater samples in the sewer system, above human-health screening levels. However, the last sentence of this section states that no further action is recommended for the sewer system. It is unclear why no further actions are recommended, when site-related contaminants have been identified in sediment and wastewater above site screening levels. Revise the text to include recommendations for future actions, or clarify why no further action is recommended for the site (e.g., the sewer systems represents an incomplete pathway).

> **Response:** The EPA and MDNR guidance are not intended for the evaluation of human health risks posed by contaminant concentrations in these media. As indicated in the 2nd sentence of the 1st paragraph of this Section:
> "The U.S. Environmental Protection Agency (EPA) Region IX and Missouri Department of Natural Resources (MDNR) did not establish the screening levels used in this SSEBS for sewer sediment and wastewater samples, but rather for soil and tap water (EPA) or groundwater (MDNR), respectively. Therefore, the detections above the Screening Levels serve only as an indication of contamination that may be present in potential releases from the sewers."
>
> As indicated in the 1st sentence of the last paragraph of this section:
> "The contaminants found in the sewer system sediments and wastewater do not appear to have an immediate means of transport to impact the soils and groundwater on the Site."
>
> If there has been any release from this system, it was not detected in the soil boring samples collected adjacent to and below the sewers, even in the vicinity of suspected breaches. The second to the last sentence of this paragraph states that:
> "Only arsenic was detected above the screening levels in both the sewer sediment or wastewater samples and in nearby soil samples."

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For more complete discussion, see **Sections 4.12** and **5.1.3**.

The following sentence will replace the last sentence at the end of this Section:
Based on the analysis of the data collected for the SSEBS, all data have been collected to characterize the nature and extent of contamination in all of the Investigation Areas in accordance with the FSP. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of localized contamination in, and directly beneath, the sewer system and sewer trenches. The vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring.

Comment 4. Section 0.4.3, Soil, page 0-5. The fourth bullet item on this page states that dioxins, polycyclic aromatic hydrocarbons (PAHs), PCBs, and pesticides detected in soils should be mostly sorbed to soil particles. However, no information is provided to support this statement. Revise the document to indicate that these contaminants "may be" sorbed to soil particles, or provide additional scientific explanation to support this statement.

> **Response:** Comment noted. See discussion in **Section 0 - Executive Summary** that provides an overview of the various sections of the report. See text in **Sections 5.2.1, 5.2.3, 5.2.4 and 5.2.5** related to contaminant persistence characteristics of dioxins, pesticides, PCBs and, PAHs, respectively. These sections include the references supporting the statements contained therein indicating that these compounds strongly sorb to soil particles and organic matter.

Comment 5. Section 0.4.5, Investigation Areas Requiring Additional Data, page 0-7. The text states that no additional data is required to fully characterize the nature of extent of contamination in any of the investigation areas. However, at least two investigation areas have extent of contamination in one or more directions, defined by process knowledge (copper contamination in the former billet yard), and the property boundary (PAH contamination associated with Building 4). While it is appropriate to use process knowledge or a property boundary to identify initial areas for preliminary site investigations, it its not appropriate to use these criteria to define nature and extent of contaminants. Revise this document to clearly demonstrate that nature and extent has been completely characterized, or conduct additional sampling, as necessary, to accomplish this task.

> **Response:** See **Response to Comments 3. Section 0.4.5** will be revised to read:
> *Based on the analysis of the data collected for the SSEBS, all data have been collected to*

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characterize the nature and extent of contamination in all of the Investigation Areas in accordance with the FSP to satisfy the SSEBS and Baseline HHRA in support of the FOSET process. For each Investigation Area, the type, location and number of samples collected meets the Data Quality Objectives defined in Section 3 of the FSP. Depending on the future uses of the Site and the risk management decisions, additional studies may be warranted to further evaluate the possibility of contamination in the following areas:

- *PCB-contaminated concrete in Buildings 1, 2, 4 & 5*
- *Localized contamination in, and directly beneath, the sewer system and sewer trenches*
- *The vertical extent of contamination in borings where contamination exceeded the Screening Levels in the deepest sample from that boring.*
- *Asbestos and lead-based paint contamination throughout the buildings*
- *Waste characterization prior to waste disposal*
- *Characterization of potential contamination below the deadman pads for the former Building 10 USTs*

The last sentences of **Section 4.1.2** will be revised to read:
The northern and southern extents of contamination are not defined and may extend beyond the former billet yard, however process knowledge suggests that metal contamination from storage of steel billets is not expected to extend beyond the edges of the former billet yard. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of additional copper contamination in this area.

The **SSEBS** effort did not plan for or implement sample collection/analysis to assist in the characterization of off-site contamination. Based on the characterization results from nearby samples described in **Section 4.3.2**, the last sentences on **Page 4-7** will be revised to read:
The PAH contamination west of Building 4 is not defined but may extend to the north to boring location RA-RDSB-06E, to the south and west property boundaries, and east to the western foundation wall of Building 4, since the soil horizon in question does not exist east of this wall. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of additional PAH contamination in this area.

The initial agreed upon planning effort did not contain provisions in the Final **FSP** or the **CSP Addendum** for collecting contingency samples at depths deeper than specified in the Final **FSP**. There were 40 soil borings with contamination in the deepest sample exceeding one or more Screening Levels. Of these exceedances, 22 were only related to

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beryllium, which is suspected to be a natural constituent of the clay found in the deeper soils at the Site. To clarify the extent of the **SSEBS** investigations, the following sentence will be included before the tables that show the soil boring sample results in **Section 4-Nature and Extent** for each Investigation Area where this occurred: "Depending on the future uses of the Site, the vertical extent of contamination may also require additional studies in borings where contamination exceeded the Screening Levels in the deepest sample from that boring as indicated by "**" after the Field ID in the following table:"

(See Attached **Section 4 Table Revisions** showing the introductory paragraph and the revised tables with "**" indicating all the exceedances in the deepest samples)

Comment 6. Section 0.4.6, Investigation Areas to be Addressed in the Baseline Human Health Risk Assessment, page 0-8. The last sentence of this section states that the Sewer System Investigation Area will not be addressed in the HHRA, unless isolated detections less than 11 feet below ground surface are of high enough concentrations to initiate "hotspot" analyses. However, no criteria is present to quantify what constitutes "high enough · concentrations." Revise the text to include the criteria that will be evaluated to determine whether "high enough concentrations" are present to warrant "hotspot" analyses. Additionally, include results of the "hotspot" analyses in the HHRA.

> **Response:** The 2nd bullet of **Section 3.3** of the **Baseline HHRA** defines the "hotspot" areas and the results of the hotspot analyses are included in **Section 5.2.1.1.** For clarification, the last sentence of **Section 0.4.6** on **Page 0-8** will be revised to read: "For the Sewer System Investigation Area, the only soil samples to be addressed in the Baseline HHRA "hotspot" analyses will be the isolated samples collected at depths less than 11 feet bgs containing contaminants at concentrations exceeding the Screening Levels."

Comment 7. Section 1.1, Purpose of Report, page 1-1. This section states that American Society for Testing and Materials (ASTM) Method E 1527-97, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, was followed in the completion of the **SSEBS**. However, the most current version for this method is ASTM E 1527-00 (updated in 2000). Revise the text to clarify that an outdated ASTM method was used, or revise this document based on the newer method.

> **Response:** This reference will be revised to indicate that the Phase II ASTM guidance was followed and the text and reference will be revised to read:
> "Finally, this SSEBS and the HHRA will support the Army in the Finding of Suitability

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to Transfer (FOST) determination process in accordance with American Society for Testing and Materials (ASTM) Method D 6008-96, "Standard of Practice for Environmental Baseline Surveys," and ASTM Method E 1527-97, "Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process." (ASTM, 1998)."

Comment 8. Section 1.3.3, Manufacturing Processes after 1944, 2nd paragraph, page 1-5. The text's reference to **Appendix A, Figures 6.5** through **6.13** revels that Figure 6.5 and Figure 6.3 are identical (pre 1944 view of Bld 3). Was this in error? If so publish the right Figure for Figure 6.5.

> **Response:** **Figure 6-5** will be replaced with the correct figure from the **Comprehensive EBS, Building 1 Major Equipment Layout.**

Comment 9. Section 4.1.2, Soil, page 4-3. The last sentence in the second full paragraph states that the northern and southern extent of copper contamination are defined by "process knowledge" at the edges of the former billet yard. It is unclear how the northern and southern extent of contamination are defined by "process knowledge," without further explanation or presentation of analytical data. "Process knowledge" can be used to define initial investigation areas, but because contamination can migrate, only appropriate site sampling activities can be used to define nature and extent of analytical data.

> **Response:** The last sentences will be revised to read:
> *The northern and southern extents of contamination are not defined and may extend beyond the former billet yard, however process knowledge suggests that metal contamination from storage of steel billets is not expected to extend beyond the edges of the former billet yard. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of additional copper contamination in this area.*

Comment 10. Section 4.12.1, Sediment, page 4-20. The referenced sample site (SRSB-02) is shown on the south side of Bld 2. The actual sample was collected on the north side of Bld 2 but from site SRSB-27. Revise the text to reflect this.

> **Response:** The referenced sample location should read "SRSD-02" which is located on the north side of Building 2. The text in paragraphs 1 and 2 of **Section 4.12.1** will be revised as follows:
> *Dioxins were detected in the only sample, SRSD-02 north of Building 2, collected as part*

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of the CSP at concentrations above the respective soil screening levels.

PCBs were detected in all five of the samples at concentrations above the soil screening level. PCBs were also detected in the one sample, SRSD-02 north of Building 2, collected as part of the CSP at concentrations above the soil screening level.

Comment 11. Section 4.3.2, Soil, page 4-7, and Section 4.4.2, Soil, page 4-9. These sections state that the extent of PAH contamination is defined on one side by the property boundary. It is unclear how the property boundary serves to define the extent of contamination if no data exist south of the property boundary. Revise the document to either clarify that the nature and extent has been determined, based on appropriate sampling of potentially contaminated areas, and coincidentally coincides with the property boundary, or state that no data exist to define the southern extent of PAH contamination, and that PAH contamination may exist south of the property boundary.

> **Response:** See **Response to Comment 5.** The **SSEBS** effort did not plan for or implement sample collection/analysis to assist in the characterization of off-site contamination. Based on the characterization results from nearby samples. The last sentences will be revised as follows:
>
> *The PAH contamination below the oil storage pad is defined by samples from boring locations 06SB-01 on the west and RA-RDSB-10E on the northwest, and may extend to the property boundary to the south and along the entire hillside south of Building 5, but could extend further. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of additional PAH contamination in this area.*

Comment 12. Section 6.1, Summary of Nature and Extent of Contamination, page 6-1.
Known asbestos-containing corrugated transite siding is present in Buildings 1 and 2, and should be discussed in this section. However, no information was provided to allow for conditions in Buildings 1 and 2 to be determined. Revise the document to include this information.

> **Response:** As stated in the last sentence of the 2nd paragraph of **Section 1.3.4**, the **Comprehensive EBS** found site-wide asbestos containing materials and therefore this information was not included in the **SSEBS**. The introductory paragraph for **Section 6** describes what is included in this section of the **SSEBS**.
>
> The 2nd sentence of this paragraph will be revised to read:
> "For items in **Table 1-12** where no additional investigations were performed under this

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SSEBS, the original findings from the Comprehensive EBS stand and the results are not repeated in this Section."

Comment 13. Section 6.2.1, Building Materials and Product Samples, page 6-4. The fifth bulleted item states that the two products found in Building 2 do not require further action because they are not defined as PCB-containing wastes. While the product samples may not contain PCBs, they are petroleum hydrocarbons, which should be properly removed and disposed to prevent a future release. Revise the text to provide a recommendation that products identified in Building 2 should either be further investigated and identified, or be removed and properly disposed.

> **Response:** The following text will replace the referenced bullet:
> **"Product Samples** - The two products found in Building 2 are not defined as PCB-containing wastes. No further characterization is recommended for the SSEBS."
>
> Waste management recommendations are not within the scope of this document. The purpose is stated in the 1st sentence of Section 1.1:
> "The purpose of this Site-Specific Environmental Baseline Survey (SSEBS) is to document the environmental condition of the St. Louis Army Ammunition Plant (SLAAP), herein referred to as "the Site", including the nature, type and extent of contamination."

Comment 14. Section 6.2.2, Sewer System, page 6-5. This section states that no further action is recommended for the sewer system, although site-related contaminants were reported in sewer sediment and wastewater. In an effort to reduce the probability of a future release of contaminants from sewer sediment, it is suggested that an evaluation for future removal of sewer system sediments be added to this report. However, the last sentence of this section states that no further action is recommended for the sewer system. It is unclear why no further actions are recommended, when site-related contaminants have been identified in sediment and wastewater above site screening levels. Revise the text to include recommendations for future actions. Revise the text to include recommendations for future actions, or clarify why no further action is recommended for the site (e.g., the sewer systems represents an incomplete pathway).

> **Response:** See **Responses to Comments 3 and 13.** The last sentences of this Section will be revised to read:
> "At this time, no further characterization data is required. Depending on the future uses of the Site, additional studies may be warranted to further evaluate the possibility of localized contamination in, and directly beneath, the sewer system and sewer trenches."

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Comment 15. Section 6.2.5, Investigation Areas Requiring Additional Data, page 6-5. The text states that no additional data is required to fully characterize the nature of extent of contamination in any of the investigation areas. However, at least two investigation areas have extent of contamination in one or more directions, defined by process knowledge (copper contamination in the former billet yard), and the property boundary (PAH contamination associated with Building 4). While it is appropriate to use process knowledge or a property boundary to identify initial areas for preliminary site investigations, it its not appropriate to use these criteria to define nature and extent of contaminants. Revise this document to clearly demonstrate that nature and extent has been completely characterized, or conduct additional sampling, as necessary, to accomplish this task.

> **Response: See Responses to Comments 5 and 13.** The text will be revised to read:
> *Based on the analysis of the data collected for the SSEBS, all data have been collected to characterize the nature and extent of contamination in all of the Investigation Areas in accordance with the FSP to satisfy the SSEBS and Baseline HHRA in support of the FOSET process. For each Investigation Area, the type, location and number of samples collected meets the Data Quality Objectives defined in Section 3 of the FSP. Depending on the future uses of the Site and the risk management decisions, additional studies may be warranted to further evaluate the possibility of contamination in the following areas:*
> - *PCB-contaminated concrete in Buildings 1, 2, 4 & 5*
> - *Localized contamination in, and directly beneath, the sewer system and sewer trenches*
> - *The vertical extent of contamination in borings where contamination exceeded the Screening Levels in the deepest sample from that boring.*
> - *Asbestos and lead-based paint contamination throughout the buildings*
> - *Waste characterization prior to waste disposal*
> - *Characterization of potential contamination below the deadman pads for the former Building 10 USTs*

Comment 16. Section 6.2.6, Investigation Areas to be Addressed in the Baseline Human Health Risk Assessment, page 6-6. This section states that a number of potential "hotspots" will be evaluated as part of the HHRA. It is unclear how "hot spots" will be or have been identified for the site, as well as the current location of previously identified "hot spots." Revise the text to include information on how "hotspots" will be identified at the site, as well as information-specific "hotspots" locations.

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Response: The Hotspot selection process was defined in the 2nd bullet of **Section 4.3.2** of the Final **FSP**. The 2nd paragraph of **Section 6.2.6** on **page 6-6** will be replaced with the following text paraphrased from **Section 3.3** of the **Baseline HHRA**:

*A number of potential "hotspots" were evaluated as part of the SSEBS. Potential "hotspots" are relatively small areas where known or suspected releases may have occurred. Examples include stained soils under machinery, locations where the Comprehensive EBS found chemicals present above screening levels or areas where chemicals were reportedly handled but where no data exists. These hotspot areas typically cover a small fraction of the area covered by the building or investigation area with which they are associated. For purposes of the risk assessment, all soil data collected from the 0-10 foot bgs interval during the SSEBS, including those designated as "risk assessment samples" in the FSP will be included in the hotspot evaluation. "Hotspots" are defined as discrete areas of contamination where one or more chemicals are present at concentrations above screening levels (e.g., "exceedances"). A hotspot could consist of one or more samples. In the event that adjacent samples showed exceedances, they were pooled as a single hotspot. Samples with no exceedances were used to identify the boundaries of the hotspots, and will not be included in the hotspot dataset when calculating risks. A summary of the individual hotspots to be evaluated in the Baseline HHRA is presented in **Table 6-1** and shown on **Figure 6-1**.*

Table 6-1 and **Figure 6-1** will be added to the SSEBS and are the same as **Table 3-1** and **Figure 3-3** of the **Baseline HHRA**.

Comment 17. Section 2, Site-Specific Investigations, page 2-1. The third paragraph of this section states that 757 soil samples were collected. This is not consistent with the number of soil samples reported in other sections of the SSEBS (e.g., pages 0-2, 0-5, and 4-5). Revise the text so that the correct number of soil samples are presented at all places it is referenced.

Response: A total of 757 soil samples were collected during the **SSEBS** field investigations. The table on **Page 0-2** refers to the total number of samples analyzed for all media. The text on page 0-5 references the total number of samples analyzed for a particular contaminant, (eg. 584 soil samples were analyzed for arsenic, and 583 soil samples were analyzed for beryllium, etc.). The text on **Page 4-5** agrees with the text on **Page 0-5** referring to the 583 beryllium soil samples analyzed.

For clarification, the sentence before the table on **Page 0-2** will be revised to read: "The following table summarizes the total number of samples analyzed for all media and for each group of compounds within each Investigation Area and the Regional Background samples with a Site-wide total including the Regional Background samples:"

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Section 2. Human Health Baseline Risk Assessment

Table 3-4 Revisions

Table 3-5 Revisions

Responses to MDHSS Comments

Write-up for Tables 3-4 and 3-5

Responses to EPA Comments

FIGURE 3-4
LOGIC DIAGRAM FOR SELECTING A PARAMETRIC METHOD FOR ESTIMATING THE 95% UPPER CONFIDENCE LIMIT FOR SITE ANALYTICAL RESULTS
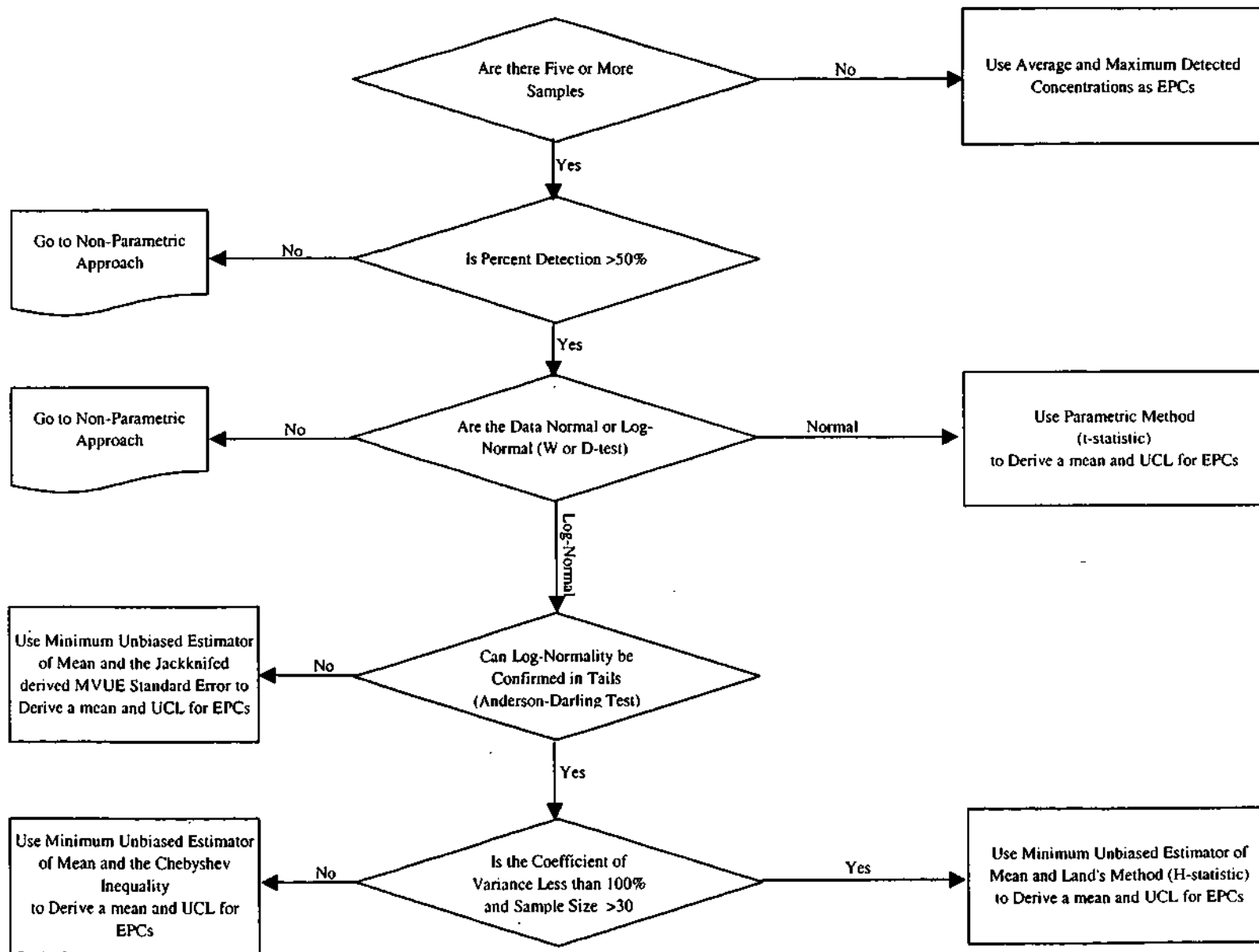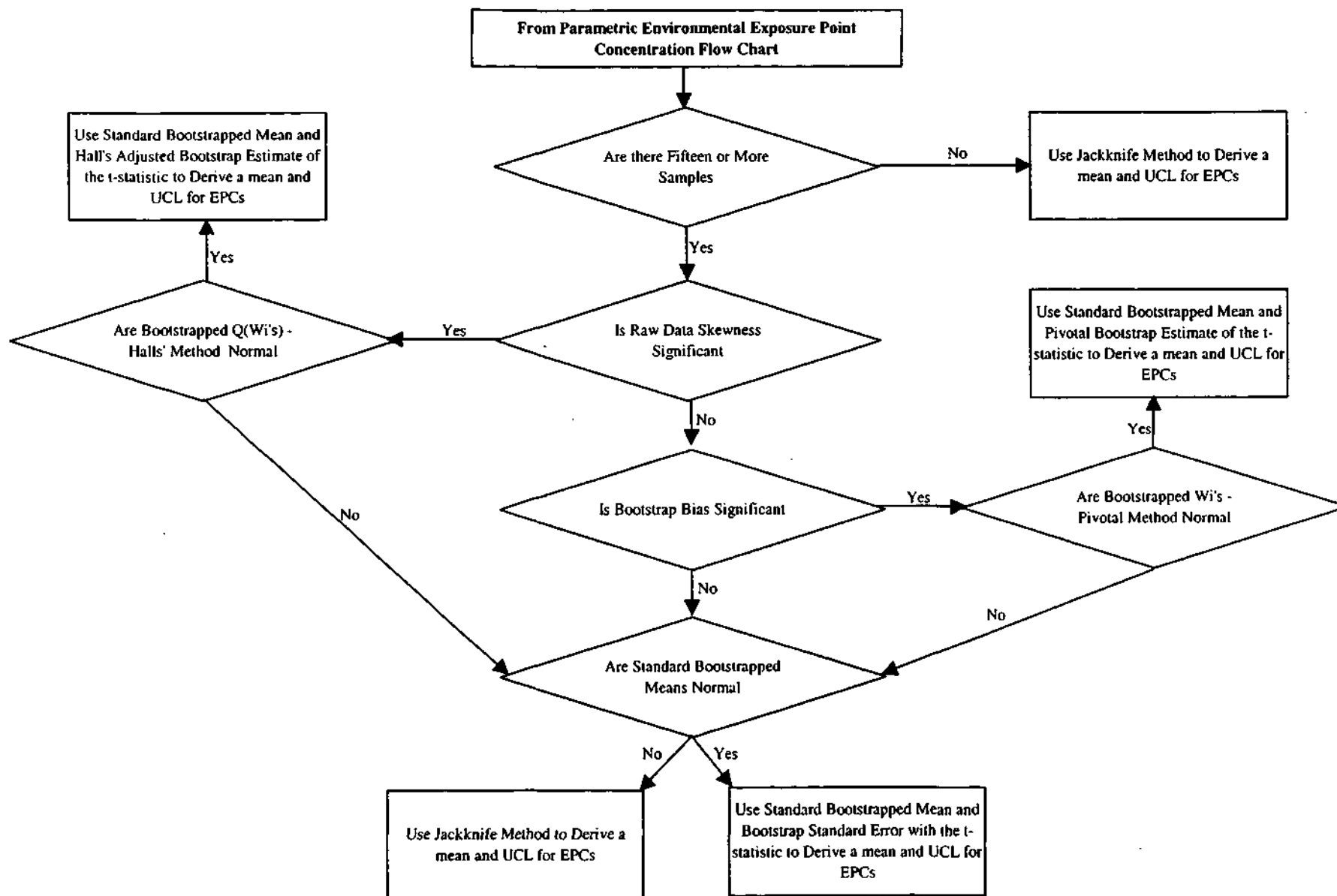
FIGURE 3-5
LOGIC DIAGRAM FOR SELECTING A NONPARAMETRIC METHOD FOR ESTIMATING THE 95% UPPER CONFIDENCE LIMIT FOR SITE ANALYTICAL RESULTS

RESPONSE TO COMMENTS
DRAFT BASELINE HUMAN HEALTH RISK ASSESSMENT FOR
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Comments from Missouri Department of Health and Senior Services dated November 19, 2003.

General Comments:

Comment 38. No applicable or relevant and appropriate requirements (ARARs) were discussed in the document. Please discuss appropriate laws that apply to the site in Section 1.

> **Response:** Comment noted. A discussion of ARARs is outside the scope of a risk assessment and is typically included in a Feasibility Study or Engineering Evaluation and Cost Analysis that would be in a follow-on activity for SLAAP.

Comment 39. The accepted range of threshold values for cancer is the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) of 10^{-4} to 10^{-6}. The risk assessors chose to use the lower end of the NCP range as a target cancer risk value. We prefer the DNR's Cleanup Levels for Missouri (CALM) target risk level of 10^{-5}. In the Summary and Conclusions Section, the text should be revised to note that the final target risk level within the range of 10^{-4} to 10^{-6} would be determined by the DNR or the Environmental Protection Agency (EPA) or by both agencies.

> **Response:** Comment noted. The **Baseline HHRA** makes no attempt to establish acceptable risk levels for the Site (a risk management decision), but instead identifies those COPCs and exposure areas with potential risks that exceed both MDNR <u>and</u> EPA risk criteria. The following sentences will be added to the end of the second paragraph on **page 7-1**:
> "The 10^{-4} risk criterion is utilized within the HHRA for comparison purposes, since risks that exceed this level are above both EPA and MDNR benchmark levels, and represent a level of concern. The acceptable risk level for the Site has not been established and will ultimately be determined as part of a risk management decision that is beyond the scope of the HHRA."

Comment 40. The property transfer should specify site use as industrial/commercial for the following reasons: 1) Institutional or engineering controls are needed for portions of the site because of hotspots and contaminated soil beneath the footprint of several buildings that exceed threshold values. 2) The site-wide resident scenario reasonable maximum exposure (RME) threshold values were exceeded (hazard index (HI) = 5.9 and cancer risk (CR) = 1.1E-4). 3) Building two was sampled for dioxins with nearly the entire footprint of the building identified as a hotspot. 4) Excluding the hotspots, the entire site is not badly contaminated based on the present BHHRA and intended industrial/commercial use (site-wide risk: HI = 0.56 and CR = 2.6E −5; Table 5-2), but the lack of sampling for dioxins over the entire site potentially under-estimates the site-wide risk. One cannot assume that background levels of dioxins would equal

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those on the remainder of the un-sampled site, if no dioxin background samples were taken. For this reason, USACE and BRAC should consider determining the extent of the dioxin contamination, through either random sampling or judgmental sampling of potential dioxin areas.

> **Response**: Comment noted. The determination of the Site's future use is a risk management decision that is outside the scope of the **Baseline HHRA**. The dioxin sampling was completed in accordance with the final **Field Sampling Plan (FSP) - Part I of the Sampling and Analysis Plan** and the **Contingency Sampling Program (CSP) Addendum** in and around Building 2. Samples from this Investigation Area were analyzed for dioxins because process knowledge indicated that they could possibly have been formed by the exposure of PCBs to high temperatures. Data collected during the CSP indicated a significant decrease in dioxin concentrations immediately outside of Building 2 compared to those concentrations found in soils inside the building, and they were considerably below the Screening Levels. Risks of exposure to dioxins in Building 2 are presented in the **Baseline HHRA** and the uncertainties were addressed in the 2nd paragraph of **Section 6.6.1** on **Page 6-1** as follows:
>
> *Another sampling uncertainty involves the suite of analytes that were analyzed. In particular, dioxin analysis was not conducted over most of the Site. In the area where dioxin analysis was conducted (Building 2), the dioxins contributed 2 X 10^{-5} risk to the residential scenario. Samples collected around the outside of Building 2 contained lower dioxin levels. Given the incineration activities that occurred at Building 2, in conjunction with the presence of PCBs, it is not surprising that dioxins were present. While it is likely that dioxin levels are lower on other portions of the Site, and that some dioxins are likely to be present as anthropogenic background, the lack of dioxin data may result in an underestimation of risk for the remainder of the Site.*

Comment 41. As stated on page 5-10 of the risk assessment, many buildings exceed regulatory standards for lead, PCBs, and asbestos. Risk associated with these materials was not quantified because of the lack of risk protocols. We believe the property transfer should be made with the understanding that the buildings should be not be reused, but demolished. Unless a comprehensive survey of contaminants, subsequent removal of hotspots, and confirmation sampling in each building is completed, the buildings should not be used.

> **Response**: Comment noted. The determination of the Site's future use is a risk management decision that is outside the scope of the **Baseline HHRA** and should be made at a later time by risk managers.

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Comment 42. Given the age of this site, were organic forms of lead found in petroleum products sampled?

> **Response**: Comment noted. The Final **FSP** established target analytes based on process knowledge, which indicated that gasoline was not a primary constituent of the petroleum products used on the Site. Due to the lack any known gasoline releases on the Site, the Final **FSP** specified only the characterization of total lead and not organic lead.
>
> As indicated in **Table 12-1** of the Final **FSP**, gasoline storage or releases were not listed as areas of concern as the gasoline underground storage tanks were removed prior to the Comprehensive EBS and evaluated in this earlier study. The only area of concern listed in the FSP on **Page 1-18** was the Building 3 Area with high gasoline hit – near UST next to Building 3, however this area was remediated along with Building 3. As further evidence of this, the **SSEBS**, as indicated in **Table 4-5 - Site-wide Data Summary**, found that there were no detections of any of the Benzene, Toluene, Ethylbenzene or Xylene (BTEX) compounds normally associated with gasoline in any of the media sampled at concentrations greater than the Screening Levels.

Specific Comments:

Comment 43. The executive summary should briefly mention how contaminants of concern (COC) were determined (i.e., comparison to both the Tier 1 CALM screening values and EPA Region IX Preliminary Remediation Goals (PRGs) should be included).

> **Response**: Comment noted. On **page 0-1** the final sentence of the third paragraph states: "These data were screened against risk-based screening values, including both the Preliminary Remediation Goals (PRGs; USEPA, 2002a) and CALM screening values (MDNR, 2001), to identify the Chemicals of Potential Concern (COPCs) for quantitative evaluation in the HHRA."
>
> The screening was in accordance with the **Risk Assessment Workplan** in the Final **FSP**, in the 3rd complete paragraph of **Section 4.2** on **Page 4-2** which states:
> *COPCs will be selected for each area/medium/exposure pathway by comparing the relevant analytical data to EPA Region IX Residential Preliminary Remediation Goals (PRGs) and MDNR CALM Scenario A levels (which are based on residential exposures). Any constituent with a detected value in exceedance of either screening value will be selected as a COPC for the relevant pathway or pathways. Chemicals with no detected concentrations will not be considered COPCs for an exposure area/pathway.*

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Comment 44. In Section 2.1 and 2.2, URS discusses the identification of COCs for subsurface soils and groundwater, but does not define: 1) the soil or groundwater screening value used (if this was decided in the IDR, then this should be cited), i.e., Region IX PRGs, CALM or Maximum Contaminant Levels (MCLs), and 2) how frequency of detection is used in the screening process.

> **Response: Sections 2.1 and 2.2** state that any chemical exceeding either the PRG or CALM value will be considered a COPC. The frequency of detection was not stated as a criterion and was not considered, since any detection above the screening level qualifies a chemical as a COPC, a highly conservative approach in accordance with **Section 4.2** of the Final **FSP**.
>
> The following sentences will be added to reference **Tables 4-2** and **4-3** of the SSEBS since these tables present the screening level for each target analyte:
>
> After the third sentence of the first paragraph of **Section 2.1** on **page 2-1**:
> "The risk based screening levels used for each target analyte in soil are presented in **Table 4-2** of the SSEBS (URS, 2003)."
>
> After the third sentence of the first paragraph of **Section 2.2 on page 2-1**:
> "The risk based screening levels used for each target analyte in groundwater are presented in **Table 4-3** of the SSEBS (URS, 2003)."

Comment 45. In Section 3.5, we could not determine how individual soil samples were combined and statistically tested for each exposure area or the site-wide area to develop exposure point concentrations (EPCs). Attachment B illustrates some of the calculations used to determine EPCs. Please include a more detailed description of the procedure.

> **Response:** The 2nd Paragraph of **Section 2.1** on **Page 2-1** of the **Baseline HHRA** includes the following discussion the two groups of soil COPCs:
> *For purposes of evaluating potential exposure to surface and subsurface soils by different receptor populations, soil COPCs were separated into two groups. Potential exposures to surface soils were based on soil analytical data collected from 0 to 6 inches bgs. Because the deepest trench that a future excavation worker is reasonably expected to dig is about 10 feet bgs, exposures to subsurface soils were based on soil analytical data collected from 0 to 10 feet bgs.*

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Page 4-10 of **Section 4.3.4** of the Final **FSP** describes the calculation of exposure point concentrations for each media in which exposure may occur. A computer program that follows the USEPA EPC guidance, referenced as USEPA 2002c in the **Baseline HHRA**, was used to calculate the EPCs. The attached flow charts with written explanation of the program's operation will replace **Figure 3-4** and have been included as an attachment to these responses as **Figures 3-4 & -5**. The second to last sentence of the last paragraph of **Section 3.5** on **Page 3-9** will be replaced with the following to introduce this attachment: "**Figures 3-4 & -5** presents a flow diagram outlining the rationale used in the calculation of the 95% UCL for both the Parametric and Nonparametric methods, including supporting text. These methods were verified by the California Department of Toxic Substances Control and have been accepted by the EPA Region V and the Illinois Environmental Protection Agency. in submitted/accepted risk assessments."

Comment 46. In Section 4.3, Table 4-1, Arsenic is missing the inhalation risk value. The EPA's Integrated Risk Information System (IRIS) has an inhalation unit risk of 4.3E-3 ug/m^3.

> **Response**: Comment noted. As explained in **Section 4.3.1** and **Figure 4-1** of the Final **FSP**, inhalation was considered to be a minor exposure pathway for non-volatile chemicals such as arsenic; therefore, no inhalation risk value was required.

Comment 47. In Section 4.4, URS states that for this risk evaluation, soil lead concentrations were compared to CALM residential values and the Adult Lead Model range of 750-1,750 mg/kg. We believe that this comparison is insufficient to evaluate the true risk to site- wide lead. Inputs and assumptions for the Adult Lead Model or the Integrated Exposure Uptake Biokinetic (IEUBK) model should be provided for our review.

> **Response**: The 750-1,750 range is based on the default "Adult Lead Model" assumptions; including exposure frequency, duration and population makeup. Since there is no current population on the Site, the model cannot be customized for Site-specific conditions and the standard default assumptions must be used. For conservatism, the lower value (750 mg/kg) can be used for comparison purposes, since it is based on the most conservative (vulnerable) receptor population, i.e., a pregnant female Site worker. The final paragraph of **Section 4.4** on **page 4-3** will be revised as follows:
> *The IEUBK model as applied by MDNR identifies an allowable surface soil lead level of 260 mg/kg for residential soils, a level thought to be protective of children. Although no workforce is currently present at the Site, use of default worker assumptions in the Adult Lead Model results in an allowable surface soil lead concentration for uncontrolled exposures in the range of 750-1,750 mg/kg, depending on the demographic makeup of the*

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> *workforce. This range is considered protective of a developing fetus in a pregnant site worker. For this risk assessment, lead soil concentrations were compared to both 260 mg/kg and 750 mg/kg.*

Comment 48. In Section 5.0, transport-modeling results were rather difficult to understand and were not summarized well. For example, in Section 5.1.2, the risk assessor should have defined the Johnson and Ettinger (J&E) Model assumptions in the risk assessment write-up. Why did the assessor choose to use the default values? We should not have to assume the reason. The vapor intrusion risk is low; in addition, on the entire 21-acre site only one monitoring well had volatile organic compounds (VOC) that were used in the modeling.

> **Response:** As with the Adult Lead Model, default assumptions were used as a conservative screening approach since they are more likely to overestimate risk than underestimate risk. It is important to note that the worst-case groundwater monitoring well data were used and assumed to be representative of the entire Site, thereby utilizing a conservative approach to estimating risk. The existing monitoring well is not under any existing buildings and as such assumes a building could be placed in the worst-case location in the future. The final paragraph of **Section 5.1.2** on **page 5-5** will be revised as follows:
> *Since the buildings currently on the Site are likely to be replaced prior to reoccupation of the Site, the conservative default exposure parameters were used in all J&E calculations (i.e., the standard J&E screening defaults). These default parameters are designed to be protective of residential properties (homes), and are considered protective for other building uses, such as commercial/industrial buildings. Exposure point concentrations were based on the maximum detected VOC concentrations in groundwater, thereby making a conservative assumption that the highest VOC concentrations found on the Site are present throughout the Site.*

Comment 49. In the Summary and Conclusion Section, please include those exposure areas that exceed the CALM target risk level of 10^{-5}. Next, mention that the target risk level within the range of 10^{-4} and 10^{-6} will be determined by the DNR or the EPA or by both agencies.

> **Response:** See **Response to Comment 39.** References to the summary tables, which identify areas exceeding risk levels of 10^{-4}, 10^{-5}, etc., will be added to the **Baseline HHRA.**

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Comment 50. In summary, the BHHRA presents a nearly complete assessment of the current and potential exposures to past activities at the SLAAP. In general, the Department of Human Health and Social Services (DHSS) believes that the 21-acre SLAAP property should remain an industrial/commercial area. To be suitable for transfer, dioxin sampling should be completed on the remainder of the site. To protect future site workers from the undetermined risk of exposure to building contaminants, a careful evaluation of each building should be completed or the buildings should be demolished. Finally, DHSS has concerns that necessary contaminant modeling and model descriptions and assumptions were omitted or inadequately addressed. When DHSS' concerns are addressed and incorporated into the BHHRA, we believe that the SLAAP BHHRA will provide useful risk information regarding contaminated soils, groundwater, and vapor intrusion into buildings to be used in the FOSET process.

> **Response:** Comment Noted. See **Responses to Comments 40 & 48** and the Risk Assessment Workplan included as **Section 4** of the Final **FSP**.

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STATISTICAL METHODS FOR ESTIMATING 95% UCLs

Environmental exposure point concentrations (EPCs) are the exposure concentrations used in assessing risks. EPA (1992) defines the exposure "term" as the upper 95% confidence limit (UCL) for the mean media concentration to which receptors could be exposed. By definition, this EPC is statistically derived. The following statistical approach is presented in a flow chart format (Figure 3-4 and Figure 3-5) and is based on recommendations made in recent publications (e.g., EPA 1997, Schulz and Griffin 1999, EPA 2002) and further evaluation of the referenced bootstrapping methods. This approach includes distribution testing to determine whether a dataset best fits a parametric (*i.e.* normal, lognormal) or non-normal distribution, and then applies the appropriate statistical methods to calculate the mean and 95% UCL. In the process, the lower of the maximum detected value and the 95% UCL is used to represent EPC.

Data Usability and Adequacy of Samples

Datasets containing at least one detected value but fewer than 5 samples are considered inadequate for distribution testing and the maximum detected value is used to represent the dataset. Datasets containing greater than 50% detection and 5 or more samples are subjected to distribution testing.

Distribution Testing
Distribution testing is performed on datasets containing 5 or more samples. Data sets are evaluated for the presence of non-detects, as discussed above, prior to performing distribution testing. Data sets are separated into the following subgroups:

1) data sets containing less than 50% nondetect values;
2) data sets containing from 50% to < 100% nondetects; and
3) data sets containing 100% nondetects.

Distribution testing are performed on each data set containing less than 50% nondetect values using all data. Proxy values equal to one-half of the reporting limit are used for nondetect data. Elevated reporting limits for nondetect values are evaluated as potential statistical outliers using the extreme value (Dixon's) test in datasets of less than 25 and using Rosner's test for datasets with samples sizes greater than 25 (EPA 2000). If such reporting limits are found to be statistically significant outliers for the dataset and their proxy value (½ of their reporting limit) exceeds the maximum detected concentration reported within the dataset, the maximum detected concentrations are used as their proxy values for statistical evaluation.

Where datasets contain 50% or more nondetect data, the dataset is considered inadequate to perform distribution testing and a non-normal or "mixed" distribution[1] is assumed.

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[1] The potential interference associated with high levels of non-detection is due to the potential for a biomodal distribution due to a mixing of the analytical method's reporting limit(s) and the distribution of the chemical concentrations – *i.e.*, the data set represents a mixture of two distinct statistical populations.

Distribution testing are performed using the following methodologies. First, the data and the natural log transforms of the data are tested using the Shapiro-Wilks test (w-test) for normality. For data sets containing more than 50 samples, the D'agostino's test (the D-test) is used. The D'agostino test is an extension of the w-test. The w-test is based on the null hypothesis that the data are normally distributed. The test is performed with a type-I error rate of 5%. The type-I error rate (shown as the p-value in the w-test) is the probability of incorrectly rejecting the null hypothesis of normality. In the w-test, a test value < 0.05 results in rejection of the null hypothesis and it is assumed that the data are not normally distributed. For lognormally distributed data, the log-transformed data will fit a normal distribution. The w-test for normality can be used to test data for lognormal distribution using the natural log transforms of the data.

The second method used is the Anderson-Darling (A-D) test for goodness of fit. The goodness of fit test differs from the w-test in that the null hypothesis is that the data do not fit a selected distribution. Therefore, the burden of proof in the goodness of fit test is to show that the data provide a good fit to a selected distribution; whereas, for the w-test, the burden of proof is to show that the data are not normal. For goodness of fit tests such as the A-D test, a p-value greater or equal to 0.9 is an indication of a good fit (Schulz and Griffin, 1999).

The A-D test provides a confirmation method of testing for a lognormal distribution. The results of the A-D test for lognormal fit are used to corroborate the results of the w-test, particularly in cases where the log-transformed data appear not to be normal but the w-test p-value indicates that the null hypothesis of normality cannot be rejected. However, since the w-test is reputed to be one of the most stringent test available for normality (Schulz and Griffin, 1999), the w-test p-value takes precedence over the A-D test results to identify non-normal data.

Datasets that Fit A Normal Distribution

The population mean (μ) is a measure of the central tendency of a distribution. As such, it is an appropriate measure of the concentration in a medium (e.g. sediment) that a receptor may contact throughout the duration of the assumed exposure. The population mean typically is estimated using the mean of sample data (*i.e.* the average) and an upper confidence limit of the mean. For datasets that are determined to fit a normal distribution, the 95% UCL is calculated using the Student-t statistic with the following equation (from EPA, 1992):

$$UCL_{95} = \bar{x} + s \times t_{0.05, n-1} \Big/ \sqrt{n}$$

where :
x	=	sample mean
s	=	sample standard deviation
$t_{0.05, n-1}$	=	one-sided t-statistic for 5% type I error
n	=	number of samples

Datasets that Fit a Lognormal Distribution

Datasets are considered lognormal where the w-test is greater than 0.05 for log transformed data sets and an Anderson-Darling test probability greater than 0.90. The 95% UCLs are calculated using the h- statistic[2] as shown below (from EPA, 1992a):

$$UCL_{95} = \exp\left(\overline{y} \times 0.5 S_y{}^2 + S_y \times H_{0.95,n,Sy} \Big/ \sqrt{n-1}\right)$$

where:
y = mean of ln transformed data
Sy = standard deviation of ln transformed data
$H_{0.95,n,Sy}$ = h-statistic for 95% confidence limit
n = number of samples

Besides the h-statistical method for datasets that fit a lognormal distribution, Schulz and Griffin recommend that an alternative method, specifically the Chebychev inequality method, be considered. The Chebychev method provides an alternative to and check on the h-statistic and is considered a conservative estimate of the 95% UCL of a distribution. EPA (2002) also provides additional information about the use of the Chebychev inequality to estimate the 95% UCL of log-normally distributed data. For log-normally distributed data, the mean and standard error of the mean may be estimated using Minimum Variance Unbiased Estimate (MVUE) equations presented in Gilbert (1987; pg. 165). The Chebychev inequality 95% UCL has been shown to be more conservative than UCLs calculated using the other methods described above (EPA, 1999). Therefore, the Chebychev UCL provides a conservative estimate of the 95% UCL of lognormal data and is used to evaluate whether the h-statistic generates a 95[*] UCL that is unrealistically large. The Chebychev UCL equation is shown below:

$$UCL_{95} = \mu_1 + 4.47 \times \sigma(\mu_1)$$

where:
μ_1 = Ln MVUE mean estimate (Gilbert, 1987)
$\sigma(\mu_1)$ = Ln MVUE mean standard error (Gilbert, 1987)

EPA (1997) has correlated the generation of unrealistic 95% UCLs based on the use of the h-statistic with data sets that exhibit high coefficients of variation (CV) and small sample sizes. A high CV is also problematic for the Chebychev inequality. The CV is defined as the ratio between the standard deviation of the data and the mean, expressed as a percentage. A high CV, according to EPA (1997), is one greater than 100%. To correct for this EPA (1997) suggests the use of the Jackknife procedure in estimating the MVUE of the lognormal mean. To perform the Jackknife, the MVUE of the mean is calculated after deleting one observation at a time in sequence:

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[2] The h-statistic is only functional for standard deviations between 0.10 and 10. If the dataset standard deviation is outside of the bounds, the Chebychev and bootstrap methods are evaluated for use in lieu of the h-statistic methodology.

$$\phi_i = (n \bullet MVUE) - [(n-1) \bullet MVUE_{-i}]$$

Where $MVUE_i$ is the MVUE estimate after deleting the ith sample observation. The Jackknifed mean is then:

$$\Phi = \frac{\sum (\phi)}{n}$$

The Jackknifed standard error of the MVUE is the sum of squares for the Jackknifed estimates:

$$SE_{MVUE} = \sqrt{\frac{\sum (\phi_i - \Phi)^2}{n \bullet (n-1)}}$$

The UCL is then calculated based on the t-distribution and the Jackknifed standard error.

$$UCL_{95} = \Phi + t_{1-0.95, n-1} \bullet SE_{MVUE}$$

This method is recommended when unrealistic UCLs are suspected from the use of the h-statistic on log-normally distributed data – specifically when the CV is high (>100%) or when the sample size is low (<30 observations)(EPA 1997).

Datasets that do not Fit either a Normal or Lognormal Distribution

Use of the equations shown above are inappropriate for datasets that, through distribution testing, fit neither a normal or lognormal distribution or are based on a "mixed" population of detects and nondetects. Therefore, alternative methods are used for estimating 95% UCLs for datasets that are considered non-normal. Non-normal data sets provide a poor fit to normal or lognormal distributions and particularly occur where data may be artificially skewed due to biased sampling or through the combination of samples from different populations that occur within a single exposure unit. The alternative statistical procedures used for evaluating nonparametric distributions include:

1) Bootstrap;
2) Bootstrap-t;
3) Hall's Bootstrap-t Transformation; and
4) Jackknife

The major advantage of these methods is they can provide a robust approximation of the UCL without having to make assumptions regarding an underlying distribution to the data (EPA, 1997). Any method can be used, however, the Jackknife method tends to be more robust and more conservative (and thus preferred) on datasets with fewer samples

(i.e., sample sizes less than 15[3]). All of the bootstrap methods assume that the random resampling of the dataset will result in a dataset (i.e., of bootstrap means, t-statistic or Q-statistic) that will be normally distributed or nearly so. For high levels of bias, the bootstrap-t is designed to normalize the resamples while if the raw dataset is highly skewed; Hall's transformation is designed to normalize the resamples.

The underlying premise of normality for the bootstrap methods can be comprised in highly "mixed" datasets (i.e., those with very high levels of nondetects) or by the presence of outliers within the dataset (see Frey and Burmmaster 1999, Kilian 1998, Kelly 1999). Outliers are particularly troublesome for the bootstrap methods causing violations of the assumptions required for the Edgeworth expansions used in the t-bootstrap and · Hall's transformed t (see Hall 1992, Davidson and Hinkley 1997). The presence of outliers can actually increase or exacerbate the skewness observed in the parent dataset within the resampled datasets and even cause complete method failure (where the 95th percentile of the bootstrapped distribution is an empty set – see Hall 1992). Similarly, if the dataset contains a significant number of non-detections whose proxy values are constant, the bootstrap resampled dataset can be of n samples with exactly the same value. If this occurs, there is no variance within the dataset and the bootstrap methods will fail. It has been observed that such failures occur most often in smaller datasets (e.g., < 15 samples) when the percent detection is less than 50%. A final salient issue regarding the bootstrap methods is a high level of variability between simulations based on small sample sizes, especially in wide ranging datasets. Under such circumstances, the jackknife method is far more stable (reproducible) and as such, the preferred method.

A basic discussion of these methods and the underlying assumptions of normality for the resampled data is provided in Efron and Gong (1983), Hall (1992), Davidson and Hinkley (1997) as well as by EPA (1997), with further discussion of the bootstrap methods described in Schulz and Griffin (1999).

Bootstrap Methods: The standard bootstrap, bootstrap-t, and Hall's bootstrap-t transformation reflect a technique that involves random resampling with replacement of a data set of size *n* to generate many additional simulated data sets of size *n* that may be examined for variability or uncertainty (Schulz and Griffin, 1999). The standard bootstrap may provide confidence intervals that have less than nominal coverage probability due to bias and skewness reflected in the data (Schulz and Griffin, 1999). Bias is defined as the relative difference between the raw data mean and the bootstrapped mean. Bias is not considered significant unless it exceeds 25% of the raw data variance (e.g., see Efron and Gong 1983). Sample skewness can be tested for significance using the methods presented in Gibbons (1994). If neither bias nor skewness is significant, the standard bootstrap is the preferred method because the bootstrap extensions such as the Studentized (t-bootstrap) and Hall's transformation (Edgeworth expansions) can result in variable results. The bootstrap-t method is preferred when bias is high and skewness is insignificant whereas when skewness is high, Hall's transformation is the preferred method.

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[3] A sample size of 15 was selected as none of the validation exercises presented within the references have evaluated sample sizes less than 15 (see also Frey and Burmaster 1999).

The procedure for performing the aforementioned bootstrap methods for a data set containing n samples is described below:

Step 1: Calculate the raw data mean, standard deviation, and skewness:

$$\overline{X}_{raw} = \frac{\sum X_i}{n}$$

$$SD = \sqrt{\frac{\sum \left(X_i - \overline{X}_{raw}\right)^2}{n}}$$

$$v = \frac{\sum \left(X_i - \overline{X}_{raw}\right)^3}{n \times SD^3}$$

Where X_{raw} equals the mean of the raw data, SD_{raw} equals the standard deviation of the dataset, and v equals the skewness of the dataset.

Step 2: Randomly select n samples (with replacement) from the original n data and calculate the mean and standard deviation. Repeat at least 1000 times.

Step 3: Calculate the mean and standard deviation of each randomly drawn resample of the data set. Then calculated a W-value as follows:

$$W_i = \frac{\left(\overline{X}_{Bi} - \overline{X}_{raw}\right)}{SD_i}$$

Where X_{Bi} and SD_i are the mean and standard deviation of the ith resample of the data set and X_{raw} is the mean of the original data set. Repeat at least 1000 times.

Step 4: Calculate the Q statistic as a function of W for Hall's adjustment for skewness. Repeat 1000 times.

$$Q(W_i) = W_i + \frac{v \times W_i^2}{3} + \frac{v^2 \times W_i^3}{27} + \frac{v}{6 \times n}$$

Step 5: Rank the values W_i and $Q(W_i)$ from smallest to largest.

For the standard bootstrap calculate the bootstrap mean and standard error:

$$\overline{\overline{X}}_{GB} = \frac{\sum_{i=0}^{it} \overline{X}_{Bi}}{it}$$

Where it equals the number of iterations (resamples; e.g., 1000), X_{Bi} equals the mean of the ith resample and X_{GB} equals the bootstrap mean. The bootstrap standard error is:

$$\sigma_B = \sqrt{\frac{1}{it-1} \times \sum_{i=0}^{it} \left(\overline{X}_{Bi} - \overline{\overline{X}}_{GB} \right)^2}$$

The standard bootstrap 95% UCL is then calculated using the z-statistic:

$$95\%UCL = \overline{\overline{X}}_{GB} + Z_{0.05} \times \sigma_B$$

Considering the bootstrap-t method, the 50th ranked value[4] of W is used to represent "$t_{0.05}$" in the following equation for the 95% UCL:

$$95\%UCL = \overline{X}_{raw} - t_{0.05} \times SD_{raw}$$

Hall's bootstrap-t transformation proceeds by calculating the inverse of the Q(W) function of the ordered $Q(W_i)$ values:

$$W(Q_i) = \frac{3 \times \left\{ \left[1 + v \times \left(\frac{Q-v}{6 \times n} \right) \right]^{\frac{1}{3}} - 1 \right\}}{v}$$

Here again, if 1000 resamples were taken, the 50th value represents the 5th percentile such that the 95% UCL is calculated as follows:

$$95\%UCL = \overline{X}_{raw} - W(Q)_{0.05} \times SD_{raw}$$

These bootstrap approaches have the advantage that they do not rely on the assumption of a special parametric form for the distribution of the population (EPA, 1997). The underlying assumption is however, that the calculated X_{Bi}'s t-statistics (W_i's), and Q(W)'s are normally distributed. Subsequent to the bootstrap calculations, the distribution of the bootstrap statistics (X_{Bi}'s, W_i's, and Q(W)'s) is evaluated for departure from normality using the correlation between the expected quantiles of the normal distribution for the bootstrap output and the observed quantiles for the resampled datasets ($Q_{expected}$-$Q_{observed}$ plots; see EPA 2002). Such Q-Q plots are considered one of the most effective means of evaluating the bootstrap normality "fit" (see Davidson and Hinkley 1997). If the assumption of normality or near-normality cannot be met, the more robust jackknife procedure is used (more robust in its sensitivity to departure from normality).

Jackknife Method:

---

[4] The 50th W value represents the 5th percentile given 1000 resamples.

The Jackknife procedure is similar to the standard bootstrap as described above. When the data cannot be defined as normal or lognormal and the sample size is below 15, the Jackknife is preferred as a more reproducible method. The jackknifed mean and standard error are calculated as follows:

Step 1: n pseudovalues (ϕ) are first calculated by leaving out each of the observations i in turn:

$$\phi = (n \times \overline{X}) - [(n-1) \times \overline{X}_{i-1}]$$

Step 2: The jackknifed estimate of the mean is then:

$$\Phi = \sum (\phi) \div n$$

Step 3: The standard error of the mean is calculated as:

$$SE_{mean} = \sqrt{\sum (\phi_i - \Phi)^2 / [n \bullet (n-1)]}$$

Step 4: The upper confidence limit of the jackknifed mean is calculated as:

$$UCL_\alpha = \Phi + t_{1-\alpha, n-1} \bullet SE_{mean}$$

SUMMARY OF METHODS FOR CALCULATING EXPOSURE POINT CONCENTRATIONS

In light of the information presented above, the following procedure for calculating EPCs is used. The following procedure reflects the methods recommended by EPA (1997, 2002) and Schulz and Griffin (1999).

Step 1: Data Evaluation
Prepare summary statistics describing maximum and minimum concentration, mean, standard deviation, minimum reporting limits, and percentages of detected concentrations. The number of samples is reviewed to determine whether a sufficient number of samples is available for distribution testing.

Step 2: Review of Nondetects and Distribution Testing

Data Sets Containing Greater than 50% Nondetect Values: Data sets containing greater than 50% non-detects are considered nonparametric and either the bootstrap or jackknife statistical procedures is used to determine the 95% UCL. If the sample size is below 15 the jackknife procedure is used. If bias and skewness are low, the standard boostrap is used, given high bias and low skewness, the bootstrap-t method is used and if skewness is high, Hall's transformed t bootstrap method is used. The resampled dataset is further assessed for normality (i.e., the bootstraped mean, t-statistic, and/or Q(W) statistic) using

normal $Q_{expected}$-$Q_{observed}$ correlation. If the Q-Q correlation is poor for either the bootstrap t or Hall's transformed t bootstrap and if the fit is good for the standard bootstrap, the standard bootstrap method is used. If none of the bootstrap methods are found to be at least approximately normal, the more robust jackknife method is used.

Evaluation of Data Sets Containing less than 50% Nondetect Values:
Data sets containing less than 50% non-detects will be evaluated as follows:

1. The detected values are tested for normality using the Shapiro-Wilks test (w-test). For data sets containing more than 50 detected values, the D'agostino's d-test is used. A p-value of >0.05 is used as the criterion to indicate that the data are normally distributed.
2. An untransformed dataset that fails the w-test or d-test for normality is log transformed and evaluated for lognormality. A p-value of >0.05 is used as the criterion in the test to indicate that the data are lognormally distributed. If the result suggests a lognormally distributed dataset, the assumption is validated using the Anderson-Darling test. If confirmed, the dataset is treated as lognormally distributed. If not confirmed, the dataset is evaluated using nonparametric techniques incorporating lognormal theory.
3. Data that do not fit either a normal or lognormal distribution are designated nonparametric data.

Step 3: Calculation of the 95% upper confidence limit

1. For normally distributed data (i.e. the underlying distribution of detected data is normal), the arithmetic mean and standard deviation are calculated. The Students t statistic is used to calculate the 95% UCL.

2. For lognormally distributed data:

   i. If the CV is less than 100%, the mean and standard deviation of the log-transformed data are calculated. The 95% UCL is calculated using the h-statistic from EPA (1992). Also, the Chebychev inequality equation for 95% UCL (EPA, 1999) is calculated to validate the results of the h-statistic. The 95% UCLs from both lognormal theory-based equations are compared with the maximum detected concentration. If the 95% UCL based on the h-statistic exceeds the maximum concentration, the lower of the maximum concentration or the Chebychev lognormal 95% UCL value is used as the EPC.

   ii. If the CV is greater than 100%, then the jackknife procedure is used to calculate the standard mean of the MVUE of the lognormal mean from which a 95% UCL is derived.

3. When a dataset passes the initial test for lognormality but fails the Anderson-Darling conformation test, the nonparametric jackknife procedure is used to calculate the standard mean of the MVUE of the lognormal mean from which a 95% UCL is derived.

4. When the underlying distribution is nonparametric, then the entire data set including nondetect proxies is considered nonparametric and the nonparametric method (either a bootstrap or jackknife method) for estimating the 95% UCL of uncensored data described above is used to calculate the EPC following the procedures outlined for data sets containing greater than 50% nondetect values.

REFERENCES

Davidson, A.C., and D.V. Hinkley. 1997. *Bootstrap Methods and their Application.* Cambridge Series in Statistical and Probabilistic Mathematics. Cambridge University Press, Cambridge, UK.

Efron, B. and G. Gong. 1983. A leisurely look at the bootstrap, the jackknife, and cross-validation. Am. Statistician. 37:36-48

EPA, 1989. *Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual (Part A). EPA/540/1-89/002. December, 1989.*

EPA, 1992. *Supplemental Guidance to RAGS: Calculating the Concentration Term.* Publication 9285.7-081, May.

EPA, 1997. *The Lognormal Distribution in Environmental Applications.* Publication EPA/600/R-97/006, December.

EPA, 1999. *Some Practical Aspects of Sample Size and Power Computations for Estimating the Mean of Positively Skewed Distributions in Environmental Applications.* Publication EPA/600/s-99/006, November.

EPA, 2000. *Guidance for Data Quality Assessment: Practical Methods for Data Analysis: EPA QA/G-9: QA00 Update.* Publication EPA/600/R-96/084, January.

EPA 2002. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites.* Office of Emergency and Remedial Response, US Environmental Protection Agency. Washington, DC. OSWER 9285.6-10.

Frey, H.C., and D.E. Burnmaster. 1999. Methods for characterizing variability and uncertainty: Comparison of bootstrap simulation and likelihood-based approaches. Risk Analysis 19:109-130.

Gibbons, R.D. 1994. *Statistical Methods for Groundwater Monitoring.* John Wiley and Sons, Inc. New York, NY

Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring.* New York : Van Nostrand Reinhold.

Hall, P., 1992. *The Bootstrap and Edgeworth Expansion.* Springer Series in Statistics, Springer, New York, NY.

Kelly, P.A. 1999. Overview of computer intensive statistical inference procedures. Educatinal Research – Measurement and Statistics, Florida State University, February 1999.

Kilian, L. 1998. Pitfalls in constructing bootstrap confidence intervals for asymptotically pivotal statistics. Econometrics. 4:1-34

Schulz, T.W. and Griffin, S., 1999. "Estimating Risk Assessment Exposure Point Concentrations When the Data Are Not Normal or Lognormal," *Risk Analysis.* Vol. 19, No. 4, pp.577-584.

RESPONSE TO COMMENTS
DRAFT BASELINE HUMAN HEALTH RISK ASSESSMENT FOR
ST. LOUIS ARMY AMMUNITION PLANT

Comments from Tom Lorenz, Region VII U. S. Environmental Protection Agency dated November 25, 2003.

General Comments:

Comment 1. Inhalation of chemicals volatilizing from soil to ambient air, and chemicals entrained on suspended dust particles, are listed as minor exposure routes in Figure 3-1 for a current trespasser, future worker, and hypothetical future resident. Assessment of these exposures is fundamental to a baseline assessment of risks under the auspices of EPA. the EPA's Soil Screening Guidance (SSG) (1996) and subsequent supplemental documents (1999, 2001) to the SSG provide current guidance on the assessment of these pathways and site-specific development of parameters such as the volatilization factor (VF) and particulate emission factor (PEF). The EPA's 1996 SSG provides a framework for assessing these exposures under residential conditions, while the supplemental SSG from 2001 provides a framework for assessing commercial/industrial (C/I) exposures, as well as industrial exposures predicated on intrusive soil operations (construction activities). The PEF development under a construction scenario is similar to the fugitive dust Soil Screening Level (SSL) equations for other scenarios, with the exception of the health-based limit subchronic toxicity value term. The equation to calculate the subchronic PEF (PEF_{sc}) is significantly different from the residential and C/I worker equations. The PEF_{sc} focuses exclusively on emissions from truck traffic on unpaved roads, which typically contribute the majority of dust emissions during construction. The development of these parameter values can be tailored to site-specific conditions, including percent vegetative cover. While an increased percent vegetative cover can reduce the potential for wind to entrain contaminated dust particles from surface soil, it does not preclude this phenomenon. The HHRA should be revised to quantitatively assess ambient air inhalation exposure (volatiles and particulate emissions) for all relevant receptor populations.

> **Response:** Comment noted. The **Baseline HHRA** follows the approach that was presented in the **Risk Assessment Workplan** included as **Section 4** of the Final **FSP**, including all assumptions and pathways that were going to be utilized. The **Risk Assessment Workplan** was added to the Final **FSP** in response to the comments on the Draft **FSP** and after submittal of a draft of this section to EPA, MDNR & MDHSS. The MDHSS representative participated in a tour of the Site prior to finalization of this section after receipt of approval of the responses to comments.

Comment 2. Subsections under Section 5.2 should present additional data and clearly reference additional tables that present exactly which contaminants are functionally the drivers of risk and hazard. Moreover, information outlining the driving routes of exposure should also be presented. It is important to be able to understand what percentage of risk or hazard may be attributable to a particular chemical via a particular pathway in consideration of site risk management goals. This information does not appear to be easily retrievable given the current format. Each area

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discussion should be accompanied by a summary table presenting this information as well as a chemical of potential concern (COPC) selection table outlining why a given contaminant was retained or eliminated from the site-specific risk assessment. In the absence of organized information, review of the existing data tables would be extremely time intensive and was not undertaken.

> **Response**: Comment noted. The first paragraph of **Section 5.2** provides references to **Tables 5-1** through **5-6**, (which contain summary data), and **Attachment A**, (which contains the backup calculations). The COPCs for each exposure area are tabulated in **Attachment A** and, as stated in **Sections 2.1** and **2.2**, they were retained based upon whether or not they exceeded the established screening levels. For those areas with elevated risks, such as Building 5, the primary contributors of that elevated risk are mentioned individually for the benefit of decision-makers. The exposure pathways contributing the majority of risk are identified for each exposure area in the summary tables in **Appendix A**.

Specific Comments:

Comment 1. Section 2.1, Identification of Soil COPCs, page 2-1. The soil screening process outlined in this section is based on a comparison of detected concentrations to the lower of the corresponding chemical-specific value from the EPA Region IX Residential Preliminary Remediation Goals (PRGs) and the Missouri Department of Natural Resources (MDNR) Cleanup Levels for Missouri (CALM) Scenario A (residential soil) values. The incorporation of these values is excellent, however, comparison to these values should not be the sole mechanism by which COPCs are determined. Other phenomena to consider include treatment of nondetect results: in situations where a given contaminant is reported as nondetect across all sampling points, where sample analytical results are associated with elevated method or instrument detection limits (or preferably sample quantitation limits [SQLs]) these contaminants could potentially occur below detection levels at concentrations capable of eliciting an adverse human health effect. As such, these contaminants cannot be reliably restricted from the risk assessment. A qualitative assessment should be conducted within the framework of the Uncertainty Analysis and these contaminants should remain COPCs on the site-specific list for the public record. This list may be pared down through more detailed review, such as providing evidence that the contaminant in question was never stored, used or manufactured on the site, or that the contaminant is not a known breakdown product of any known on-site COPC.

In addition, for specific groupings of contaminants, if one individual or congener is retained, the greater grouping should be retained as well. For example, if one of the classified carcinogenic polynuclear aromatic hydrocarbons (PAHs) is retained as a site COPC, each of the other PAHs

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for which there is a relative potency factor (RPF), based on the toxicity of benzo(a)pyrene should be retained. Likewise, if one polychlorinated biphenyl (PCB) congener is retained, each additional congener (if detected, or associated with an elevated SQL) should be retained as a COPC as well.

> **Response**: Comment noted. Only a small number of chemicals in soil and groundwater were consistently reported as non-detect with detection limits above the screening level. In the case of soil, benzidine was the only chemical where the detection limit exceeded the screening level (the detection level is roughly equivalent to 10^{-5} risk). This chemical is not suspected as a Site-related chemical, nor was it found. In the case of groundwater, approximately 25 chemicals had detection limits above the drinking water-based screening levels, most of which exceeded their screening levels by a factor of 5X or less. However, drinking water is not a complete exposure pathway at the Site. At the reported detection limits, none of these compounds would present a significant risk in the evaluated exposure scenarios.

> See **Response to General Comment 1**. Also note that **Section 4.2** of the final **FSP** provides details regarding the selection of COPCs. **Section 4 of the FSP** presents the **Risk Assessment Workplan** including the sampling strategy, exposure assumptions, and the procedures and protocols to be followed for performing a **HHRA**. **Section 4.2** of the **FSP** does not require that the **HHRA** include compounds that are detected below the screening levels simply because they are congeners of, or related to, other compounds detected above the screening levels.

Comment 2. Section 3.2, Evaluation of Potential Exposure Pathways, page 3-2. With respect to the fundamental components of a complete exposure pathway, although URS has accurately reproduced these components from Section 6.3 of *Risk Assessment Guidance for Superfund* (RAGS) (EPA, 1989), in fact a transport medium is not fundamental to a complete exposure pathway, while a receptor population (omitted) is fundamental. Revise this section to include a receptor population as a fundamental component of a complete exposure pathway.

> **Response**: Comment noted. See **Response to General Comment 1**. The evaluation of potential exposure pathways was conducted in accordance with EPA guidance as presented in **Section 4** of the Final **FSP**.

Comment 3. Section 3.2, Evaluation of Potential Exposure Pathways, page 3-2. This section seems to indicate that volatile contaminants in groundwater may compromise overlying buildings, resulting in inhalation exposure to unspecified receptor populations. For purposes of this review, and in the absence of information to the contrary, the EPA has assumed these

receptor populations could be comprised of future C/I workers and a future on-site residential family. Figure 3-1 appears to list inhalation of volatiles stemming from groundwater as incomplete for a future worker. Please explain this apparent discrepancy. Likewise, inhalation of volatiles from groundwater by a hypothetical future resident (adult and child) is listed as a minor exposure route that will not be quantitatively evaluated in the risk assessment. It appears that, according to Section 5.1.2, the Johnson and Ettinger model for chemical volatilization into a building (*User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings* [EPA, 2003]) was used to quantitatively evaluate this particular pathway. Please resolve this apparent discrepancy and ensure that the HHRA adequately assesses indoor inhalation for a future on-site C/I worker and residential family (adult and child). Alternatively, if URS can present findings of no substantial risk based on residential exposures, this information should be sufficient to advance a qualitative assessment of C/I worker exposures as a less conservative benchmark. Figure 3-1 should also be revised to clearly identify volatilization and vapor intrusion as release mechanisms and ambient air and indoor air as tertiary sources.

> **Response:** **Figure 3-1** has been revised (see Attachment) to be consistent with the risk assessments performed and the text in the second to last sentence of the second to last paragraph of **Section 3-2**. The "IC" designation in **Figure 3-1** has been replaced with a solid bullet for both the "Future Worker" and "Future Resident" "Potential Receptors" to indicate a Complete Exposure Route which will be evaluated quantitatively in risk assessment. The figure currently identifies groundwater as a tertiary source, with inhalation of vapor via volatilization as a potentially complete pathway.

Comment 4. Section 3.2, Evaluation of Potential Exposure Pathways, Current Trespasser/Site Visitor, page 3-3. Edit this discussion to indicate that ambient air inhalation of vapors and/or particulate emissions will be quantitatively assessed for this receptor population, consistent with General Comment No. 1.

> **Response:** Comment noted. See **Response to General Comment 1.** As indicated in the last bullet on **Page 4-4** of **Section 4.3.1** of the Final FSP, "The inhalation exposure route is considered insignificant relative to the other two routes, since exposed soils are vegetated and thus unlikely to generate substantial amounts of dust."

Comment 5. Section 3.2, Evaluation of Potential Exposure Pathways, Future Excavation/Construction Worker, page 3-3. Edit this discussion to indicate that inhalation of ambient air particulate emissions (in addition to indoor air vapors) will be quantitatively assessed for this receptor population, consistent with General Comment No. 1.

Comments from Tom Lorenz, Region VII U. S. Environmental Protection Agency dated November 25, 2003.

Response: See **Responses to General Comment 1 and Specific Comments 3 & 4**. As indicated in the 3rd bullet on **Page 4-5** of **Section 4.3.1** of the Final **FSP**, the inhalation of ambient air particulate emissions was not considered to be a complete exposure route. The text in the 2nd sentence of the 3rd bullet will be revised as follows:

"For industrial/commercial workers, exposure could occur from direct dermal contact and incidental ingestion of surface soils and inhalation of VOCs released from the underlying groundwater."

Comment 6. Section 3.2, Evaluation of Potential Exposure Pathways, Hypothetical Future Resident, page 3-3. Indicate within this bulleted section that this receptor population is assumed to be exposed to indoor air vapors arising from underlying soil and groundwater and ensure that this characterization is followed throughout the HHRA. Also edit this discussion to include mention of discrete adult and child receptors. Finally, present verbiage to indicate that inhalation of vapors and/or particulate emissions will be quantitatively assessed for this receptor population, consistent with General Comment No. 1.

Response: See **Responses to General Comment 1 and Specific Comments 3 & 5**. As indicated in the 4th bullet on **Page 4-5** of **Section 4.3.1** of the Final **FSP**, the inhalation of ambient air particulate emissions was not considered to be a complete exposure route. The text in the 1st sentence of the 4th bullet will be revised as follows:

"Although residential use of the property is unlikely, a hypothetical resident (combined adult/child scenario) was evaluated for potential exposure to surface soil and VOCs. This scenario uses the same exposure routes used for the industrial/commercial worker (direct dermal contact, incidental ingestion and inhalation of VOCs released from the underlying groundwater)."

Comment 7. Comment noted. **Section 3.4.4, Incidental Soil Ingestion Rate, page 3-6.** This section indicates that the incidental Central Tendency Exposure (CTE) soil ingestion rate for a residential child is assumed to be 50% of the Reasonable Maximum Exposure (RME) rate. Provide the supporting rationale and decision criteria for this assumption. For instance, prepare an argument (using the EPA's *Exposure Factors Handbook (EFH)*, 1997) supporting the RME values as representative of upper-bound exposures (e.g., 90-95th percentiles), and defending 50% of these values as being representative of central tendency conditions.

Response: See **Response to General Comment 1**. The RME and CTE values for the incidental soil ingestion rate were developed based on EPA guidance and collaboration with the MDHSS as presented in **Section 4** of the Final FSP.

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Comment 8. Section 3.4.7, Surface Area of Exposed Skin, page 3-7. the EPA's standard default value for this parameter for a residential adult is 5,700 square centimeters (cm^2). This value should be used rather than the proposed value of 3,300 cm^2. The former value represents exposure to the face, forearms, and hands - as well as lower legs (not accounted for in the value proposed by URS). In addition, the value of 5,700 cm^2, represents the mean of the 50th percentile for male and females over the age of 18 years. Hence, this value, although approved for use in assessing RME exposures, should also be used in the assessment of CTE exposures. The value of 3,300 cm^2 should be used for assessing RME dermal exposure of adults under industrial conditions, however, this value is the mean of the 50th percentiles for males and females over the age of 18 years and, as such, is appropriate for use under CTE exposures as well. The proposed skin surface area for children of 1,913 cm^2 is lower than the approved EPA default value of 2,800 cm^2. This latter value is the mean of the 50th percentiles for male and female children less than one to less than six years of age, and as such, is appropriate for use in assessing both the RME and CTE conditions (rather than the proposed values of 1,913 and 1,440 cm^2). This value of 2,800 cm^2 takes into account exposure of the face, hands, forearms, lower legs, and feet of children. Revise the HHRA to utilize the recommended skin surface areas, as outlined above.

> **Response:** Comment noted. See **Response to General Comment 1.** The RME and CTE values for surface area of exposed skin were developed based on EPA guidance as presented in **Section 4** of the Final FSP.

Comment 9. Section 3.4.12, Inhalation Rate, page 3-8. Although URS has referenced the appropriate guidance document, the EPA's *EFH* (1997), the EPA was not able to exactly replicate the proposed values. The proposed values are generally consistent with the most commonly applied inhalation rates, however it could not be determined in our review which specific studies from the *EFH* were used or combined to develop these estimates. Generic adult inhalation rates, based on an average of moderate and heavy activity levels, produces a value approaching 3 cubic meters per hour (m^3/hr). Likewise, outdoor worker short-term breathing rates, based on an average of moderate and heavy activity levels, approaches 2.4 m^3/hr. However, both of these rates are based on the 50th percentile or mean rate and as such are appropriate for use under RME and CTE exposures, although alternative inhalation rates (under CTE exposures) may be proposed based on alternate activity levels (such as moderate and light activity levels, as proposed herein). Revise the document to provide additional information regarding the specific studies used as the basis for the proposed inhalation rates.

> **Response:** Comment noted. See **Response to General Comment 1.** The RME and CTE values for the inhalation rate were developed based on EPA guidance as presented in **Section 4** of the Final FSP.

Comment 10. Section 3.5.3, Calculation of the 95% UCL Based on Non-parametric Methods, page 3-10. The text does not indicate which constituents required calculation of the 95% UCL using non-parametric methods. The document should be revised to include a discussion of the constituents for which non-parametric methods were used, the method(s) used, and the rationale for the selection of the method(s) used.

> **Response:** **Page 4-10 of Section 4.3.4** of the Final **FSP** describes the calculation of exposure point concentrations for each media in which exposure may occur. A computer program that follows the USEPA EPC guidance, referenced as USEPA 2002c in the **Baseline HHRA**, was used to calculate the EPCs. The attached flow charts with written explanation of the program's operation will replace **Figure 3-4** and have been included as an attachment to these responses as **Figures 3-4 & -5**. The second to last sentence of the last paragraph of **Section 3.5** on **page 3-9** will be replaced with the following to introduce this attachment:
>
> "**Figures 3-4 & -5** presents a flow diagram outlining the rationale used in the calculation of the 95% UCL for both the Parametric and Nonparametric methods, including supporting text. These methods were verified by the California Department of Toxic Substances Control and have been accepted by the EPA Region V and the Illinois Envonmental Protection Agency. in submitted/accepted risk assessments."

Section 3. Conceptual Site Model
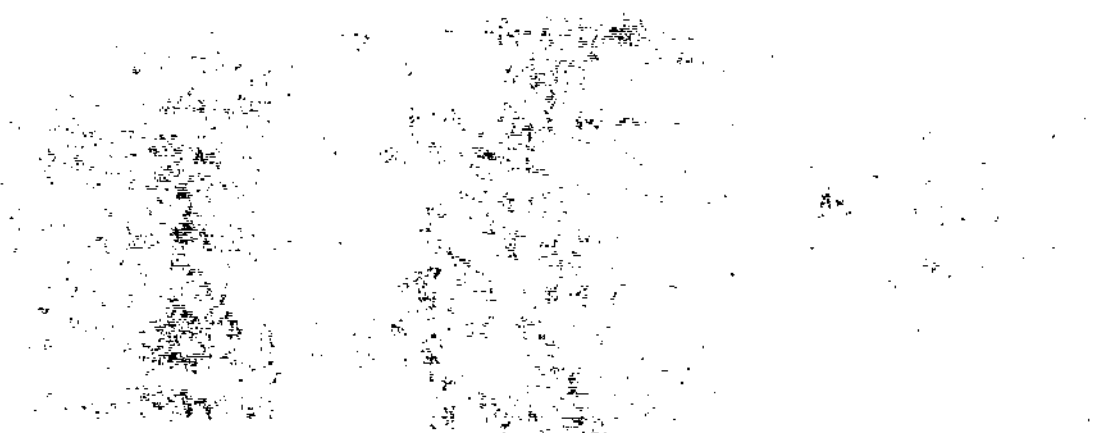
Revised Figure 3-1

Figure 3-1
Site Conceptual Exposure Model
St. Louis Army Ammunition Plant (SLAAP)
St. Louis Missouri

Primary Source	Release Mechanism	Secondary Source	Release Mechanism	Tertiary Source	Exposure Route	Potential Receptor			
						Current Trespasser	Future Worker	Hypothetical Future Resident	Future Excavation/ Construction Worker
Former Underground Storage Tanks	Product Leakage	Subsurface Soils	Trench Excavation	Exposed Subsurface Soil	Ingestion	IC	IC	IC	●
					Inhalation	IC	IC	IC	●
					Dermal	IC	IC	IC	●
Process/Maintenance Related Oils			Leaching	Groundwater	Ingestion	IC	IC	IC	●
					Inhalation	IC	●	●	●
Metal Cutting/Shaping Processes					Dermal	IC	IC	IC	●
Former Cooling Tower Operations	Product Spillage	Surface Soils			Ingestion	●	●	●	■
					Inhalation	O	O	O	■
Former Aboveground Storage Tanks					Dermal	●	●	●	■
					Ingestion	X	X	IC	IC
					Inhalation	X	X	IC	IC
Asbestos Containing Building Materials	Maintenance Activities	Building Surfaces			Dermal	X	X	IC	IC
Lead-Based Paint									

Legend:

- ···→ Incomplete/Minor pathway
- ⟶ Complete pathway
- O Minor Exposure Route. Will not be evaluated quantitatively in risk assessment.
- ● Complete Exposure Route. Will be evaluated quantitatively in risk assessment
- IC Incomplete Exposure Route. Will not be evaluated quantitatively in risk assessment.
- X The Risk Assessment cannot adequately address these exposure routes.
- ■ Future Excavation/Construction Worker exposure to surface soils will be addressed as a part of the subsurface exposure scenario.